THE

AMERICAN NATURALIST.

VOL. XV. — *OCTOBER*, 1881. — NO. 10.

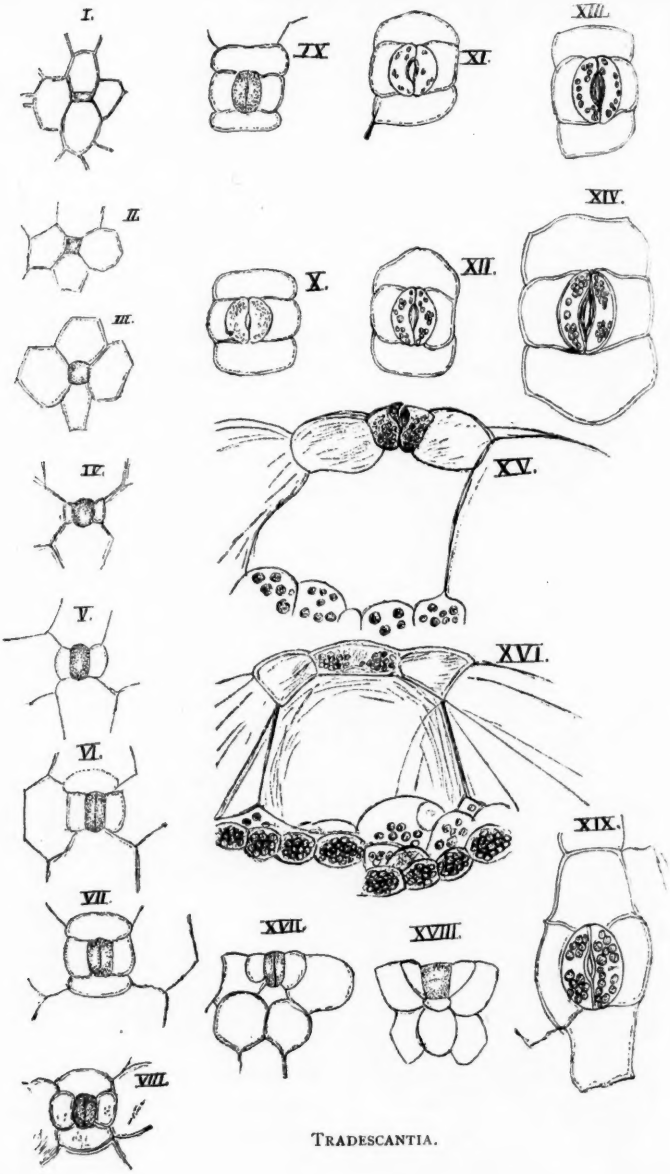
ON THE DEVELOPMENT OF THE STOMATA OF TRADESCANTIA AND INDIAN CORN.[1]

BY DOUGLASS H. CAMPBELL.

IF we examine a portion of the epidermis from the lower surface of the leaf of the common trailing Tradescantia *(T. vulgaris)*, it will be seen to consist of polygonal cells, mostly irregular hexagons. At intervals, sometimes in nearly straight rows, in other cases irregularly, are found the stomata, each consisting of two semilunar guard-cells, meeting at the ends so as to enclose a central pore, whose walls are thicker than the external walls of the guard-cells. These guard-cells contain chlorophyll in distinct grains, while in the cells of the epidermis it is wanting. Grouped around the stoma are four cells, one on each side, one above and one below. These are very different from the ordinary epidermal cells, being nearly oblong in shape instead of hexagonal. On the stems the epidermal cells are elongated, and although accessory cells are still present, they are much longer and narrower (Fig. XIX). If a vertical section is made through the stoma, the guard-cells as well as the accessory cells are seen to be much shallower than the ordinary epidermal cells, so that a large air-cavity, equal to nearly the area of these four cells is formed beneath the stoma, and communicates with the external air by means of its pore. If we examine as young a leaf as can be had, the epidermis will be found to consist of nearly regular hexagonal cells. When a stoma is to be formed, a septum is formed across one end of a cell, at right angles to the axis of the leaf, thus pro-

[1] Special course of investigation of plant structure and physiology, conducted in the botanical laboratory of the University of Michigan.

PLATE I.



TRADESCANTIA.

ducing a cell whose upper surface is rhomboidal (Plate I, Fig. I).

This cell soon becomes nearly square, and at this time, lying between four nearly equal hexagons, it is a difficult matter to see from which it was produced (Fig. II). The cell lengthens so that in a short time it is longer than broad; and the ends are much curved, while the sides are nearly straight. The stoma increases very little in depth from the first, the subsequent growth being nearly all lateral. Soon after the stoma begins to take this oblong shape, two cells, of nearly equal size, and somewhat smaller than the stoma-cell, are cut out from the two epidermal cells at the sides of the stoma (Figs. IV and V), and a little later, in the same way, two similar cells are formed at the ends (Figs. VI and VII). Near the time of the formation of these latter cells, the mother-cell of the stoma shows a tendency to divide, the cell approaching in the meantime nearer and nearer the oval of the perfect stoma. A vertical septum is formed, dividing the mother-cell into two, and as growth progresses these separate in the middle, forming a pore leading to the space beneath (Figs. IX, X and XI). The contents of the stoma are, from the first, denser than those of the epidermal cells, but chlorophyll does not appear until the stoma has attained some size. As it increases in size, the chlorophyll becomes more evident, and shows a tendency to collect in masses, until in the perfect stoma very distinct chlorophyll bodies are present (Figs. X–XIV). The accessory cells grow in about the same ratio as the stoma, so that they bear nearly the same proportion to the completed stoma that they did to the stoma when they were first formed. The air-cavity beneath the stoma is small at first, extending only beneath the stoma proper (Figs. XVII and XVIII), but it increases, extending under the accessory cells, until finally it occupies nearly the whole space beneath them (Figs. XV, XVI). These cells, as well as the stoma proper, increase little in depth after they are first formed. Occasionally the accessory cells are more in number, five or six, but this is rare, and when it does happen, they are crowded so as to occupy little more space than the normal number.

The first thing that strikes one on examining the epidermis of Indian corn, is the peculiar form of the stomata. The guard-cells, apparently, instead of being crescent-shaped, are nearly triangular, and do not meet at the ends, as would be expected.

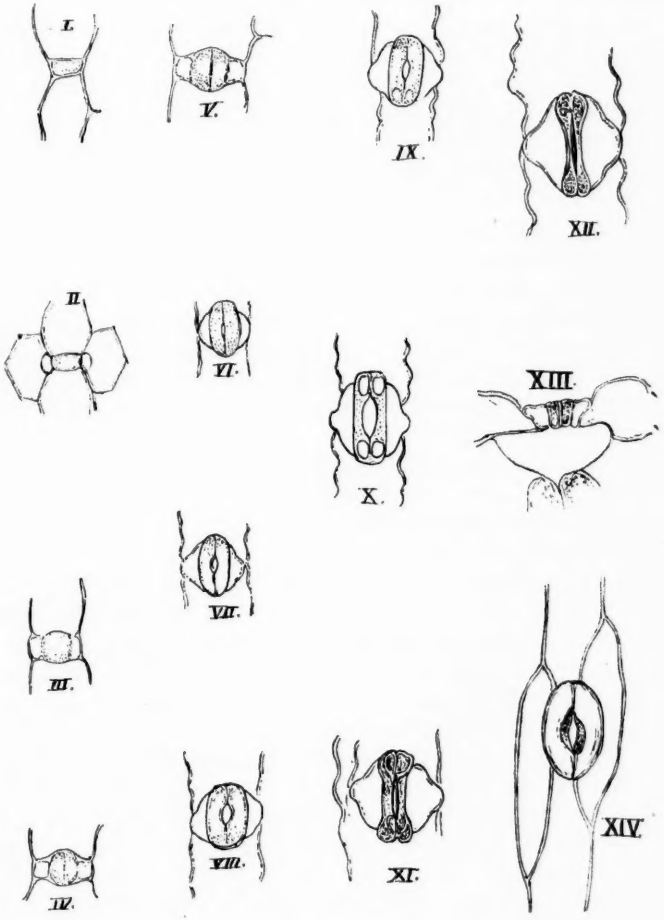
If, however, the younger forms of the stomata are examined, it is perceived at once, that what were taken as guard-cells are not really such, but are cells corresponding to the accessory cells described in Tradescantia. In the mature leaf the epidermal cells are long and narrow, and have a very marked sinuous outline; but in the young leaf they are proportionately much shorter, and have a nearly straight outline. The formation of a stoma is as follows:

A vertical septum is formed across the end of a cell, shutting off a cell, which is very short (Plate II, Fig. I). This cell, however, lengthens rapidly, and soon is nearly square in shape. The stomata are at first formed in rows, but when mature this regularity is not very obvious. Almost as soon as the mother-cell of the stoma is formed, two small cells, at the sides, are cut out from the adjoining epidermal cells, much as in Tradescantia (Fig. II). These at the outset scarcely keep pace with the development of the mother-cell; but finally grow much faster, and in the end so crowd it as to completely change its shape. The mother-cell rounds off and divides, developing for some time very much as any ordinary stoma (Figs. III–VIII); but when it is about half grown there is a marked change. The stoma gradually begins to lengthen (Fig. IX), and the accessory cells which have hitherto been small and unimportant, begin to grow more rapidly, beginning also to show their triangular form. The stoma becomes more and more elongated, and at this stage is nearly rectangular (X), and two or three times as long as broad. Distinct vacuoles are usually present and situated at the ends, but these soon disappear, and their position marks the place of greatest condensation. From this time, the accessory cells form the most conspicuous part of the stoma. They grow toward the center of the stoma, and in consequence the guard-cells become more and more contracted, until the stoma itself, instead of being oval, as it was when half grown, has become somewhat dumb-bell shaped, and to a casual observer, the accessory cells, which are no part of the stoma proper, might easily seem to be the guard-cells, while the real guard-cells are so altered that they look like mere thickenings around the pore.

The shape of the accessory cells varies somewhat, but is, in general, approximately triangular, or, rather, three-lobed; but sometimes the lobes are so indistinct, that the cells are nearly

semicircular, while at others the lobes are so strongly marked as to make the cell approach a trefoil. Occasionally, as in Trades-

PLATE II.



INDIAN CORN.

cantia, the ordinary number of these cells is increased, and an additional one is present; but this is apparently formed by the

division of one of the others. Occasionally stomata are also found on the underground stems for some distance below ground. In all such cases they are without the accessory cells, and the guard-cells are of the ordinary shape, and not compressed.

As far as I have been able to ascertain, the form of stomata found in Indian corn is general among the grasses, but usually the stoma proper is neither so narrow nor so much constricted; this is, however, not so in all cases.

In the examination of both these plants, it is necessary to examine the youngest attainable growth, as the stomata are fully formed very early. In Tradescantia, I took the bases of the youngest leaves that I could procure, those that scarcely showed at all without removing the outer leaves, and taking the youngest parts of this, placed it under the microscope without attempting to remove the epidermis. The leaf at this stage of its growth is so thin as to be almost transparent, and by careful focussing, I was able, with little difficulty, to get the youngest forms. In corn I made an oblique section of the stem quite low down, and taking out the bundle of young leaves from within the stem, treated them the same way as in Tradescantia. Only by doing this is it possible to get at the young forms, since any leaf which is firm enough to allow the epidermis to be removed, would show only forms complete, or nearly so.

In the Tradescantia the stomata are confined to the lower surface of the leaves, the upper surface being absolutely without them, while in Indian corn, although they are much more numerous on the lower than on the upper side, they are still found to some extent on the latter.

On first examining the younger forms of the Indian corn stomata, I thought that the accessory cells were formed from the mother-cell by internal division; but after having examined the formation of the accessory cells of Tradescantia, I was struck by the similarity of the two, and on reëxamination of the Indian corn, I was convinced that they were cut out of the adjoining epidermal cells, and were in all respects identical with those around the stomata of Tradescantia.

AN ATTEMPT TO RECONCILE THE DIFFERENCES BETWEEN AUTHORITIES IN REFERENCE TO THE MAYA CALENDAR AND CERTAIN DATES; ALSO TO DETERMINE THE AGE OF THE MANUSCRIPT TROANO.

BY PROFESSOR CYRUS THOMAS.

IN my former paper (AMERICAN NATURALIST for August, 1881), I reached the following conclusions:

First.—That the Ahau or Katun consisted of twenty-four years.

Second.—That but twenty of these years were usually counted.

Third.—That the grand cycle consisted of 312 years.

Fourth.—That the cycles began with the year 1 Cauac, or in other words that the Cauac column in the table of years should stand at the left.

Two important points yet remain to be determined before we are in a condition to compare Maya dates with those of the Christian era:

First.—The position of the different Katunes according to their numbers in the grand cycle.

Second.—Some one year of the Christian era that corresponds with some one year of a given Katun, or, in other words, to determine one or more contemporaneous dates of the two systems.

Before entering upon the discussion of the topic mentioned in the title to this paper, I wish to present the following additional proof that the year series commenced with a Cauac year, as this is a point which must be settled before we can feel certain in regard to any comparison made between dates of the two systems.

In the manuscript discovered by Perez and translated into English by Stephens, we find the following statement:

"In the 13th Ahau, Chief Ajpula died. Six years were wanting to complete the 13th Ahau. This year was counted towards the east of the wheel and began on the 4th Kan. Ajpula died on the 18th day of the month Zip, on 9 Ymix; and that it may be known in numbers, it was the year 1536, sixty years after the demolition of the fortress."

As the years could only begin with one of the four days,

Cauac, Kan, Muluc, Ix, which followed each other in the order here given, it is evident this Ahau must have ended on 10 Ix, and must have commenced with 13 Cauac, if we count 24 years to the Ahau. As I have shown in the previous paper that this period consisted of 24 years, I shall assume that point as settled, and will give, opposite, a table of years sufficiently extended to cover one entire grand cycle, also the closing cycle of the preceding, and the first of the following grand cycles, showing the position of the Ahaues.

As the grand cycle includes just 13 Katunes—312 years—I take for granted that the first year of this period coincides with the first year of a Katun, and consequently the close of the former coincides with the close of a Katun. By dividing the former into periods of twenty-four years, we will obtain the positions of the Katunes, and our next step will be to find their respective numbers.

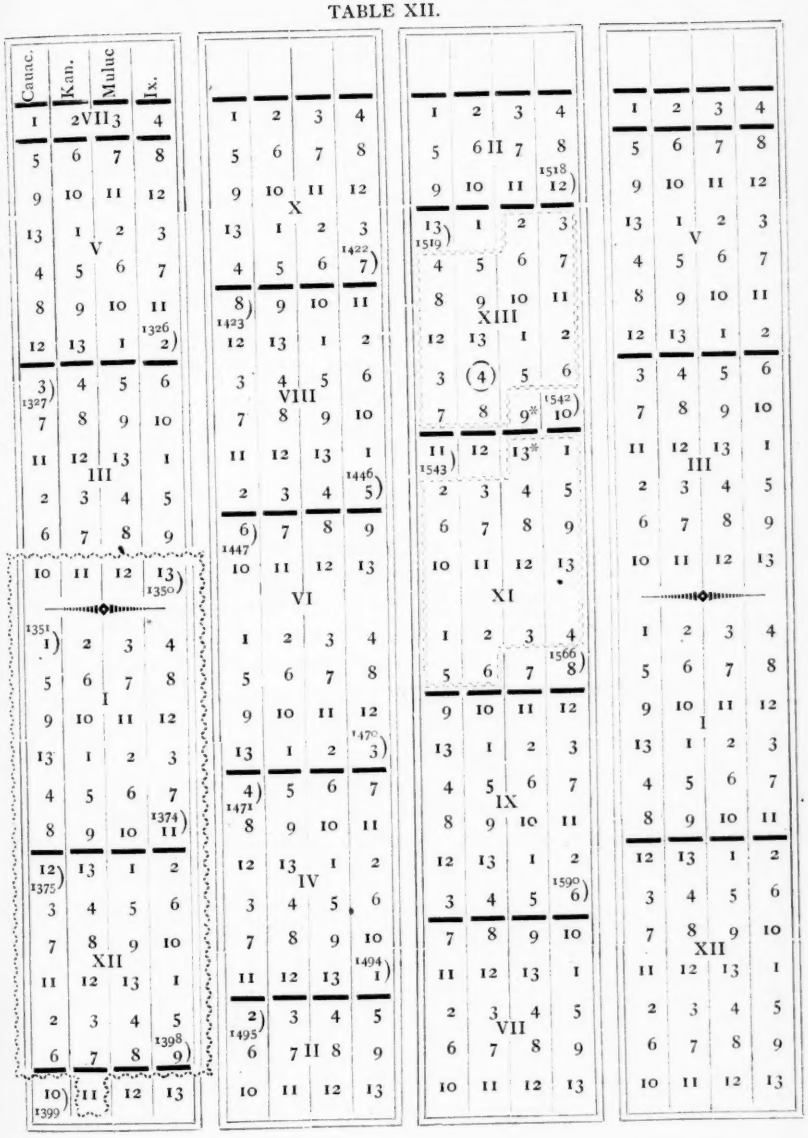
The commencement and ending of the great cycle are marked thus ——◆—— ; the divisions between the Ahaues with single transverse solid black lines. According to the quotation just made from the Perez manuscript, the 13th Ahau was one that required six years to complete it after the year 4 Kan. This can only be found in the one I have numbered XIII (the Roman numerals indicate the numbers of the Ahaues or Katunes). If we take for granted that the periods were numbered thus, 13, 11, 9, 7, 5, 3, 1, 12, 10, 8, 6, 4, 2—a point in reference to which all the authorities agree—having determined the number of one in the grand cycle, it is an easy matter to number the rest.

I call special attention to the fact that the one numbered XIII, found as above stated, begins with the year 13 Cauac ; also that the first years of the others correspond with numbers and order as given in the above series. The selection of XIII as the one with which to begin the series, was, as Dr. Valentini has given good reasons for believing, an arbitrary proceeding on the part of the Maya priests.

This numbering, as any one can see, agrees precisely with the position and numbers of the periods marked in table XI of my previous article (p. 639). The position and numbers of these periods, as I have given them here (Table XII) agree exactly with the dates in the Manuscript Troano and the Perez manuscript.

As 4 Kan of the 13th Ahau coincides with the year 1536 of

TABLE XII.


Canac. Kan. Muluc Ix.
2 VII 3
V
III
I
XII
X
VIII
VI
IV
II 8
XIII
XI
IX
VII
6 II 7
V
III
I
XII

the Christian era, we can from this easily change the years of one system into those of the other. For convenience, I have marked on the table the year of our era corresponding with the first and last of each Ahau.[1]

Now let us test this arrangement by the two or three additional dates found on record, and which the authorities have failed to make agree with any explanation of the calendar heretofore given.

Bishop Landa ("Relacion de Cosas," § 41) states that, "The Indians say, for example, that the Spaniards arrived in the City of Merida the year of the nativity of our Lord and Master 1541, which was precisely the first year of 11 Ahau."

As the Indians could have given dates only by their system and by the number of years, it follows that the Bishop connected the year 1541 of the one system with that of the first of the 11th Ahau by his own calculation.

As he understood the twenty usually *counted years* to form a complete Ahau, and supposed one of these to follow another without any intervening years, he would take 9 Muluc of the 13th Ahau—which was 1541 according to my table—as the first of the 11th Ahau (13 Muluc), according to his understanding.

In order to make this plain I have surrounded the usually counted years of the 13th and 11th Ahaues with light waved lines. I have marked the two years he has confounded (9 and 13) with a star; the year 4 Kan of the 13th Ahau, which corresponds with our year 1536, is surrounded by a dark circle.

We know from his express statement that he understood twenty years to constitute one of these periods, a fact which will probably explain the discrepancy in relation to another date which he mentions.

While writing his work in 1566, he remarks, "According to the computation of the Indians, it is now 120 years since Mayapan was abandoned." As this period must have been understood by him to include six Ahaues, the number as corrected would be 144 years, substituting this number and counting back we obtain the year 1422 or 1423—the last year of the 10th Ahau, or first of the 8th, as the one in which the destruction occurred.

Cogulludo (as stated by Dr. Valentini) places this event "about

[1] No notice is taken here of the fractional differences between the years of the two systems.

the year 1420 A. D." The Perez manuscript locates it in the 8th [1] Ahau—the one following the 10th—but without giving the year. As my calculation places it in the last year of the 10th, or first of the 8th, the agreement is perhaps as close as could be expected.

Perez states that the year 1392 of our era was the Maya year 7 Cauac, "according to all sources of information, confirmed by the testimony of Don Cosme de Burgos, one of the conquerors and a writer (but whose observations have been lost."—(Bancroft, II, 763). The correctness of this statement has been very seriously questioned because of the apparent impossibility of making it agree with the other dates. In the first place Perez started wrong by taking for granted that 7 Cauac was the *first year* of an Ahau, a supposition by no means necessary. In the second place it is more than probable he arrived at the date 1392 by calculation from the data he had before him, and not from the fact that the two dates were connected by the authority quoted from. It is certain that he or his authority must have reduced the years of one system to those of the other to have arrived at this date.

As he gives, in his calculations, the year 1493 as that on which Ajpula died, instead of 1536, as stated by his manuscript, thus antedating it by forty-three years, it is probable that this error runs through all his calculated dates. Now let us make this correction on our table by counting from the year 1392, as found there, and see what year it brings us to.

Examining the table, we see that the 12th Ahau closed with 1398, and that 1392, according to my arrangement, was the year 3 Kan of this Ahau. Counting from this forward through the six remaining years of this Ahau, the 24 of the 10th to the 13th year of the 8th Ahau (43 in all), we reach 7 Cauac; precisely the date required by his authorities. It also falls in the 8th Ahau, a fact which also appears to be demanded by his data; but it is the year 1435 of our era and not 1392. Is it not more than probable that this was the year in which Mayalpan was destroyed? It is a little strange that Perez should have made the mistake of saying that Ahau No. 2, in which his manuscript places the first appearance of the Spaniards on the coast of Yucatan, *ended* with the year 1488, and that Dr. Valentini should have overlooked this error. According to my scheme, this Ahau began with 1495 and ended with 1518, covering the correct date.

[1] Brasseur (Relac. des cos. 52 note) says erroneously, "6th."

We see from this that when the Maya calendar is properly explained, and the manifest errors of the various authorities corrected, the dates can be reconciled, and in fact furnish strong evidence of the correctness of what I have advanced in reference to the proper position and numbers of the Ahaues in the grand cycle.

The theory advanced by Perez that the Ahaues were numbered from the second day of the Cauac years, is simply a supposition based upon the name "Ahau," and the fact that the numbers of these periods, as usually given, can be found in this way, and is really the basis of all his calculations.

But we can find the same numbers, and in the order given, without resorting to this theory, as will be seen by reference to the table. Dividing the series into periods of 24 years will necessarily give these numbers as the first years, no matter where we commence the division. As will be seen by reference to the table, the Ahau in which the year 1536 falls, and which the Perez manuscript states was the 13th, commences with the year 13 Cauac, the next with 11 Cauac, and so on, precisely as given by all authorities. The only foundation, therefore, for the theory advanced by Perez, was the name "Ahau," which was doubtless applied to these periods on account of their importance in calculations of time and in giving dates.

Is there anything in the manuscript itself indicating the date at which it, or the original from which the one discovered was copied, was written?

The period embraced by the four plates XX–XXIII, which can be located in the series of years with reasonable if not absolute certainty, is evidently peculiar and not a part of the Maya calendar system. If, as I have given strong reasons for believing, it marks the close of one great cycle and the commencement of another, it will be located as shown by the heavy waved line on the table.

Why was this peculiar period given? My answer is that it probably marks the time during which the author lived, and hence was written during the latter half of the fourteenth century.

That exactly the same combinations may be found by going back one grand cycle, or 312 years, is true, but the internal as well as the external evidence, which I cannot undertake to discuss here, will not, in my opinion, allow us to carry it back to such a

remote period as the commencement of the eleventh century; that we cannot bring it down to the middle of the seventeenth century (the only possible subsequent date on the above supposition) must be admitted.

That the peculiar period embraced in plates XX–XXIII may be located where any two cycles meet is certainly true, so far as the years are concerned, but judging by the symbols and extent of the period, certain signs which seem to indicate the 3d and 1st Ahau, and from the fact that the commencement of no other cycle, except that with which the grand cycle begins, coincides with the commencement of an Ahau, I am satisfied it marks the union of two of the greatest Maya periods.[1]

——:o:——

THE SIPHONOPHORES.

III.—PHYSOPHORIDÆ (ANIMALS CLOSELY RELATED TO AGALMA).

BY J. WALTER FEWKES.

IN the two previous articles[2] in the NATURALIST, we have sketched in outline the anatomy and development of Agalma, which is regarded as the typical genus of a family of tubular jelly-fishes to which is given the name of Physophoridæ, in distinction from others yet to be mentioned, which are but distantly related to the type chosen. Before we go further a consideration of the different genera found in this family may be of interest to our readers.

All the genera now to be described agree in this particular, that they have a float, or air bladder, to support themselves in the water in which they live. Stem may fail, the attached nectocalyces, covering-scales and "tasters" be wanting, but the float always remains with the feeding-polyps, tentacles and sexual-bells represented in some form or other. To trace the different modifications in structure among the members of the group, and to show how now one part, and now another is modified, yet leading to no new plan of structure, is a most interesting and

[1] *Errata in the First Article.*—In second line from the bottom of page 631, after the words "17th day of the 2d" add "or 15th," so as to read "17th day of the 2d or 15th month." In third line from the top of page 636, for "governing" read "covering." In second line from the top of page 639, for "each period" read "each two periods."

[2] NATURALIST, September, 1880, March, 1881.

instructive study of these forms of life. Let us, therefore, consider in turn the more important genera allied to Agalma which constitute the so-called Physophoridæ.

One of the simplest members of the group is a genus in which we have present, as it were the mere skeleton of the Agalma, or simply the float and the stem. To this stem is added feeding polyps and sexual-bells, while all other appendages, as necto-calyces, covering-scales, "tasters" and the like, are wanting. It is, in fact, as if the Agalma had dropped all such as superfluous, and retained only those parts necessary for its life; polyps to eat for the community, a float to support the stem in the water, and sexual organs to reproduce new colonies. We are to consider a genus which is one of the simplest, and on that account can very properly be described in this place.

The name of the animal to which reference is made, is Rhizophysa, which is one of the rare Siphonophores of the Mediterranean and other seas. Its bizarre form and simplicity of structure gives to it an interest second to none of the Physophoridæ, and as is the case with a study of all aberrant forms, a few words about its general anatomy may do something to bring about a better understanding of the group of jelly-fishes, of which Agalma may rightly be regarded a representative. The body of Rhizophysa is a simple, flexible, transparent tube, at one end of which is a float (*a*), Fig. 11, filled with air to support it in the water. This tube, besides being extremely flexible, is highly muscular, and can be contracted into a shapeless snarl under the air bladder, or elongated into a straight, transparent, thread-like axis, as shown in the figure. Sensitive to the least touch of a foreign body, it is seldom quiet, contracting or expanding its length by muscular action of the stem walls. In no

FIG. 11. — Rhizophysa.

respect does this axis differ from that of Agalma, with which it is morphologically identical.

The appendages to the axis are few in number, but very important. Whatever structures hang from its walls are those only which are necessary to the life of an animal so low in structure as Rhizophysa. There are no swimming-bells for propulsion through the water. It is a passive agent of wind and tide, and like many other pelagic animals, irrespective of itself is helplessly borne along hither and thither as they carry it.. Covering-scales also fail along the stem, for they likewise are needless in an organism of this low kind. The organs necessary to the life of the animal, those of digestion and reproduction, cannot fail, and these are all which are to be found appended to the walls of the body of Rhizophysa.

At intervals along the stem, when expanded as shown in Fig. 11,[1] there will be noticed flask-shaped bodies, which closely resemble the polypites of the Agalma colony. These are the "feeding-mouths," and if the distal end of each of these bodies be examined, an opening through which the food is taken in will be found, while in the cavity of the polypite the half digested fragments of small animals betray at once the character of these bodies. The cavity of this polypite communicates with that of the body extending from one end to the other of the axis, through which it is brought into connection with the interior of every other organ of the animal.

From the base of each of these feeding-polyps, there hangs down a long tentacle, beset along its whole length with pendants or tentacular-knobs of a form very different from that of the Agalma. There are three kinds of these pendants, each of which has a characteristic shape which is very different from that figured in my former article, as of the tentacular-knob of *Agalma elegans*. There is no other structure in the organization of the Siphonophore which varies so much and assumes such a variety of form as the tentacular-knobs, and upon these differences we rely in the main for generic and specific characteristics among the Siphonophores. Rhizophysa has three kinds of these tentacular appendages, and in that respect differs from most other Siphonophores where only one form of pendant is found in the adult.

[1] Fig. 11 was taken from a paper by the author of this sketch in Proc. Bost. Soc. Nat. History, Vol. xx.

Midway between each pair of polypites on the axis of Rhizophysa, there will be noticed a small cluster (*e*), which when magnified will be found to have a botryoidal shape and to hang from the axis by a small slender pedicel. These organs are ovaries, and correspond with the sexual bells of the Agalma colony, although they never take on a bell shape as is true of the latter genus. How the egg is formed in these clusters, and what the character of the development of Rhizophysa is, no one has yet been able to make out with any degree of certainty.

In recapitulation, these then are the only structures which the skeleton-like Rhizophysa has: an axis *(b)*, with a terminal float *(a)*, polypites, or feeding-polyps, *(c)*, from which arise many tentacles *(d)*, closely set with tentacular knobs, and sexual organs *(e)* in the form of botryoidal clusters situated midway between each pair of feeding-polyps.

In Rhizophysa we have one of the simplest expressions of the group of animals of which Agalma has been taken as a type. There is but one simpler related animal, and that is a form in which the stem is wholly wanting, and nothing remains to indicate the affinities of the animal with the Physophoridæ except the float. We then have a well-known Siphonophore commonly figured as a representative of the group and called Physalia, or the Portuguese man-of-war.

In this curious animal there is no sign, whatsoever, of stem, swimming-bell or covering-scales, and the float is enormously developed into a bladder, which swims on the surface of the water, and acts in a way as a sail, to the spread of surface in which a raised crest also contributes. The colony of individuals is clustered on its under side, and in that position is borne along through the water. Physalia is, in some respects, the simplest possible form of Physophore and most distantly removed from the type, Agalma. Its close relation to Rhizophysa indicates that it is a true member of the group and not closely related to the floating hydroids Velella and Porpita, which I have already followed McCrady in separating from the Siphonophores.[1]

The genus Physophora or the "float-bearer," which has given the name of Physophoridæ to the group, is not perfectly normal, and differs in some respects from the type Agalma. Physophora has never been found in American waters, although quite com-

[1] Bull. Mus. Comp. Zool., Vol. VI, No. 7.

mon in the Mediterranean, and found likewise in the Atlantic near the Cape Verde islands. It is one of the most beautiful and graceful of all the group to which it belongs.

Physophora differs from Agalma and from all other Physophoridæ in this particular, that the polyp-stem to which is affixed polypites, covering-scales, tasters and sexual organs in Agalma, and which takes on the form of a long tube in this animal, becomes reduced in length in Physophora and inflated into a special bag, from the under side of which, in a definite spiral arrangement, structures similar to those of the polyp-stem in the Agalma, hang. It is precisely what would be expected if the portion of the axis of Agalma below the lowest nectocalyx were inflated into a sac, and the appended structures drawn into a spiral line over its under surface. The nectocalyces and the nectostem do not essentially differ in the type and in Physophora. The peculiar tentacular pendants of this animal I will not consider at length, since an account of them would draw me into a description too technical for these papers.

One genus of the Physophoridæ, closely related to the young of Agalma, remains yet to be mentioned. It will be remembered that we described the Agalma as passing through what was called an Athorybia stage. That form is permanently taken by the genus Athorybia, from which it was named. The resemblance of the two is, however, only a likeness in general shape, and is, in particulars, quite remote, for when we study the form of the covering-scales, the tentacular pendants and the fine anatomy of the float, we find very little resemblance between the two. The term "Athorybia stage" is a very convenient one to designate a well marked larval condition of the young even of other genera besides Agalma.

In the genus Athorybia there are no nectocalyces, and if any axis is developed, it is so small as to be practically wanting. In place of swimming-bells, the covering-scales are capable of quite extended motion, and arise directly under the base of the float, thus forming a crown or circlet which encloses that body. To the outline and arrangement of these structures, as well as the complete absence of nectocalyces, Athorybia owes its peculiar shape. It is probably an arrested embryonic condition resembling closely the young of Agalma, although differing from it in structural details.

There remains among the Physophoridæ, closely resembling in general outline the type Agalma, several genera which should be mentioned in this place. One of these is so well marked that it can be easily distinguished at a glance, and in one important particular is different from all the other Physophores. It will be remembered in my account of the arrangement of the swimming-bells of Agalma, published in the first article of this series, that I described these organs as arranged in two rows, the lines of the two series apparently opposite on the axis. As is true also of other genera, where nectocalyces occur, this appearance of being placed in two rows on different sides of the stem, is brought about by a twisting of the axis itself, and not by a formation of the bells on opposite sides. If the axis of Agalma has its fibers straightened, all the covering-scales, swimming-bells and the like, would be found one above the other in a line. Consequently the biserial arrangement of the swimming-bells is wholly distinct from their place of apparent origin on the axis, but dependent upon the twisting of the axis itself. In the genus Stephanomia,[1] instead of the section of the stem between the position of origin of two nectocalyces taking a turn through an angle of 180°, thus bringing the nectocalyces into two series; the stem between two adjoining swimming-bells is twisted at a smaller angle, even one less than a right angle, so that the openings of the bell cavity face on all sides. There still remains a serial arrangement of the bells, but in Stephanomia it is no longer biserial as in Agalma, but multiserial with the bells opening in all directions in a plane at right angles to the axis. The polyp-stem in this beautiful genus resembles that of an Agalma, but the feeding-polyps are mounted upon long peduncles, so that the tentacles seem to originate on the polypites midway between the stem and the mouth. Covering-scales of peculiar outline are also present, as well as "tasters," and male and female sexual-bells. In all of these structures, the genus is very characteristic, and if its whole organization be considered, is probably the highest member of the family. The arrangement of the swimming-bells, opening as they apparently do on all sides of the stem, make it possible for the whole colony to move rapidly through the water, and nothing can excel the grace with which these animals make their way through

[1] This genus was commonly called Foskalia by European naturalists; Stephanomia has a prior claim as its true name.

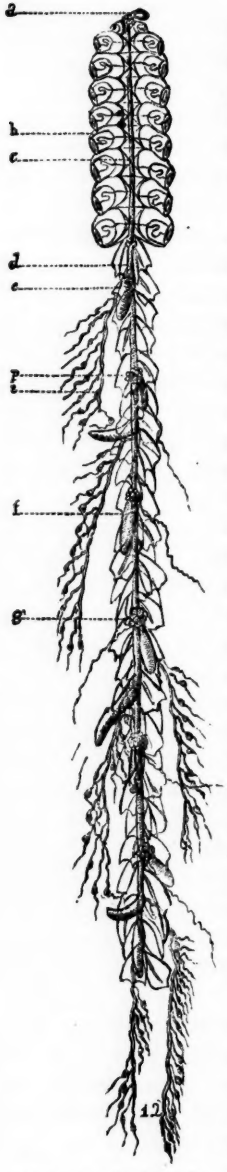


FIG. 12.—Agalmopsis.

their native element, when the combined movements of different series of bells impart a spiral motion to the whole colony. In truth, the grace of this animal is something marvelous, and when once seen is not soon to be forgotten.

There are two genera of Physophores closely resembling Agalma in external shape, but so well marked that they are commonly placed in different genera. They are known as Agalmopsis, and Halistemma. The likeness of the former of these animals to Agalma, as its name betrays, is very great (Fig. 12[1]). The most important difference between the two is in the structure of the tentacular-knobs, which in Agalmopsis (Fig. 13) have but a single terminal filament, while in Agalma, as has been already pointed out, there are two of these terminal filaments and an intermediate vesicle. In minor details also, as in the position of the sexual-bells upon the base of the "tasters," instead of midway between the feeding-polyps on the stem, Agalmopsis differs from Agalma, but as has been already said, the general outline of the two is much the same.

FIG. 13.—Pendant knob of Agalmopsis.

The genus called Halistemma, or "sea-tube," approaches very closely, in form, the type Agalma. The great difference between the two, as between Agalmopsis and

[1] Figs. 12 and 13 are copied from my paper in the Bull. Mus. Comp. Zool., Vol. VI, No. 7.

Agalma, lies in the form and arrangement of the pendant tentacular-

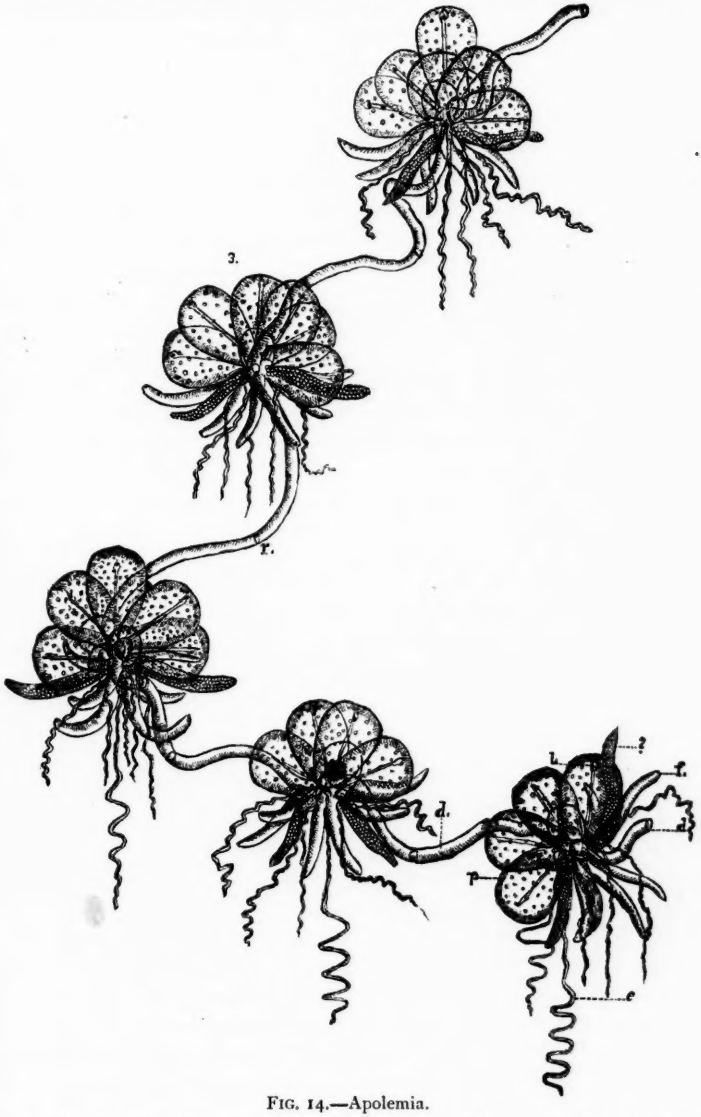


FIG. 14.—Apolemia.

knobs. In Halistemma as in Agalmopsis, there is but a single

terminal filament on each knob, but there is no involucrum such as we have already shown covers the "sacculus," or body of the knob in Agalma. Moreover, these knobs do not hang from tentacles, but each one is suspended separately from the base of the polypite, and what appear to be tentacles are in reality their pedicels very much elongated.

All the genera mentioned in the previous pages constitute a natural group of float-bearing jelly-fishes. They are closely allied to one another, and all possess an air bladder or float.

There remains one more genus to be described, which is doubly interesting from its great size and its relationship to a group of tubular jelly-fishes which has little in common with Agalma. This genus is called Apolemia, and is known to the Italian fishermen, on whose shores it is most abundant, as the "lana di mare," or wool of the sea. It often reaches, when extended, a length of from twenty to thirty feet, and is seldom found entire, but generally in the form of broken fragments like that figured in Fig. 14.[1]

The main difference between Apolemia and Agalma lies in the fact, that while in the latter the covering-scales are fastened along the whole length of the polyp-stem, and no visible break occurs where these structures are not found, in Apolemia the feeding-polyps and covering-scales are united together in clusters at intervals on the stem, separated from each other by a bare portion *(d)* of the axis, which is destitute of appendages of any kind. The fragment figured above gives a general view of a portion of such an Apolemia, but if the whole colony were figured and the remainder of the axis shown, upon one end would be found a float just as in Agalma, and four or five pairs of swimming-bells, arranged in a like biserial manner. There is, however, this peculiarity of the portion of the stem, which bears the nectocalyces in Apolemia, that from it also hang bodies closely resembling "tasters," yet destitute of tentacular filaments. This is, as far as I know, the only instance among the Physophoridæ where the nectostem has tasters arising from it. They are not as a consequence found along the polyp-stem as in most other genera.

If now we turn our attention to an examination of the clusters of bodies arranged at intervals along the polyp-stem as in Fig. 13, we find each cluster of peculiar shape, differing greatly from

[1] The figure (Fig. 14) was copied from the Bull. Mus. Comp. Zool., Vol. VI, No. 7.

what we have already studied. The stem, half way between each cluster *(r)*, is jointed so that as the animal grows, or the stem elongates, that cluster most distant from the float ruptures its connection with the colony at the joint in the axis, and when separated from the remainder, leads an independent life. It thus happens that these little clusters are often found floating alone in the water, hanging from the fragment of the stem, having broken their connection with the parent, or rather with the colony, to which they were formerly attached. As is also the case in a larval stage of a common jelly-fish, Aurelia, known as the strobila, which is, however, attached at one extremity to the ground, successive terminal members continually separate from the collection and swimming away, develop into new Aureliæ, so terminal clusters of the free-swimming Apolemia are successively broken off from the colony as it matures. The likeness between the method by which Aurelia and the clusters of Apolemia develop is morphologically very great. Let us consider the composition of a single cluster which has separated in this way from the colony, and see how far this likeness can be traced.

The fragment of an Apolemia ruptured from the remainder of the colony, resembles closely in shape a number of transparent spheres fastened together by one pole, from which hang down a number of polyp-like organs. The cluster is, in the main, composed of many jelly-like bodies joined together on the fragment of the stem. These bodies are but modified covering-scales, and are generally penetrated by a single tube, just as is found universally to be the case among other genera. The covering-scales are carried uppermost as the cluster floats in the water. From the lower side, and also attached to a segment of the axis, there hangs down the same flask-shaped feeding-polyps *(f)*, which have been described in Agalma. The tentacles *(c)* of the feeding-polyps do not bear pendants as are found in all the other Physophores except Physalia. In each cluster of polyps there are two flask-like bodies, in general shape not different from the remaining, which have a bright red color. We are unable to assign any reason for this peculiar coloration in these two feeding-polyps. Lastly, in each cluster of the Apolemia colony we find sexual-bells, male and female, which fill out the complement of organs necessary for the independent life of the cluster.

On account of this independence of life in each cluster, when

separated from the colony, it is evident that we have a condition of life in this instance very different from that usually met with among lower animals, especially among the jelly-fishes. Apolemia is, without question, a colony composed of many members, which in younger stages are attached together in the form of a Siphonophore, but as it grows older, each colony breaks up into many fragments, each of which lives wholly independent of its neighbor. The growth of a fragment after it has been separated from its connections, has never been traced, and it is not known how long or short that life may be, but in other genera belonging to a group of Siphonophores, quite unlike the Physophoridæ, the whole history of the growth of such a fragment has been followed. Apolemia is very interesting from its relationship to this form known as Diphyes, the type of a large family of Siphonophores called the Diphyidæ. The anatomy of this animal will be pointed out in a paper to follow the present, after which its curious relatives can be better understood, and the reasons why they are not placed in the group with Agalma better appreciated.

——:o:——

THE LOESS IN CENTRAL IOWA.

BY R. ELLSWORTH CALL.

ON the 16th of May last, the writer discovered unmistakable loess under and around the city of Des Moines. Following are the details of the discovery, and such notes thereon as may be of general interest.

It might be well to remark that this formation has hitherto been known only in Western and Southwestern Iowa, as has been reported by the various surveys and explorations sustained by the General and State Governments; and in Southeastern Iowa, as reported on to the Muscatine Academy of Science, by Professor F. M. Witter, formerly of that city. He found the loess under certain portions of Muscatine, with its characteristic fossils, a list of which, if my memory serves me, he reported with his paper. A reference is made (White's Geology of Iowa, Vol. I, p. 114, foot note) to a deposit of the loess near the source of one of the branches of the Raccoon, east of the great water-shed of the State, but which of the three branches of the Raccoon is meant, or the locality of the deposit, is not indicated.

The occurrence of the loess in extensive outcrops, over areas subjected at a previous time to geological investigation, but of which no mention is made, and that, too, in Central Iowa, was wholly unexpected. The formation was first seen, and its true nature surmised, at a point some two and one-half miles west of the city of Des Moines, on a branch cut of the C. R. I. & P. R. R. The cutting was made in the course of building a branch to the State Fair Grounds, in the summer of 1880, but the nature and true geological age of the material through which it passed seems to have remained wholly unknown. Subsequently outcrops were seen and studied at various places in and around the city, and specimens of the soil, the characteristic concretions and fossils, were taken from them all. Some of these exposures, owing to recent excavations like those in process of completion on Capitol Hill, in East Des Moines, show the deposit to be very extensive, and indicate that the higher lands, for some distance to the east and west of the Des Moines river in this locality, are composed in great part of true loess.

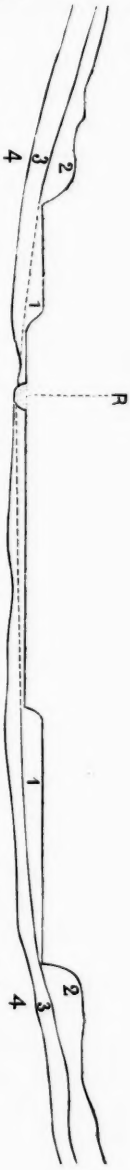


FIG. 1.—Section across Des Moines river, above the city of Des Moines, Iowa. 1, Terrace; 2, loess; 3, drift; 4, clay.

Fig. 1 is representative of an actual section, as it may be seen at a point some three and one half miles above the city of Des Moines, on the river of that name. It will be seen from this section that the loess forms the bluff or face of the *third terrace*, and probably forms the mass of the higher land in the immediate vicinity of the stream. Beneath the loess is found the drift, and beneath that again the clays of the coal measures. The river has cut its channel, by corrasion, through the formations mentioned, and in some localities has eroded a channel through the sandstones found beneath the clays. Geologists will be able to form their own conclusions from these *data*, and see in them, perhaps, some of the

results of those great continental oscillations which have contributed so wonderfully to change the physical aspects of this region. The number and height of the terraces indicate extensive areas of depression and subsequent elevation.

It might here be noted that the lithological or physical features of these local deposits differ in no appreciable degree from the loess of the Missouri valley, with which it is probably synchronous, and also of the same ultimate origin. The fossils found in the loess at this point thus far, are a single spine of a fish, among the vertebrates, and among the invertebrates the following land and fresh-water shells: *Mesodon thyroides* Say, *Patula alternata* Say, *P. striatella* Anth., *Hyalina arborea* Say, *Vallonia pulchella* Müller, *Stenotrema monodon* Rack., *Helicodiscus lineatus* Say, *Strobila labyrinthica* Say, *Pupa fallax* Say, *P. armifera* Say, *P. pentadon* Say, *Helicina oculata* Say, *Succinea obliqua* Sar., *Limnophysa humilis* Say, and *Limnophysa desidiosa (?)* Say. Another species of the subgenus Patula, is, perhaps, *P. strigosa* Gould, and is represented by four specimens not well preserved. Root marks abound in some parts of the exposures. The woody matter having decayed, has left the cavity partially filled with carbonaceous material, while the mass of the concretion-like remains thus referred to vegetable origin, is strongly impregnated with the sesquioxide of iron. The presence of this oxide is in itself one of the strong reasons for regarding these remains as fragments of fossilized roots. It is not here necessary to revert to the composition of roots, for the reason that the fact of their containing a large per cent. of oxide of iron is well known. It has been thought best to record simply the finding of the loess in this vicinity, and leave to others the forming of any theories of the deposit.

——:o:——

NOTES ON THE EARLY LARVAL STAGES OF THE FIDDLER CRAB, AND OF ALPHEUS.

BY A. S. PACKARD, JR.

The Zoëa of Gelasimus pugnax.—While at Fort Macon, North Carolina, in 1870, I collected a number of the common fiddler crab (*Gelasimus pugnax* Smith) with eggs. May 15th segmentation had in some just taken place, the blastoderm having formed, while in others the zoëæ were about ready to hatch, and were seen to be surrounded in the eggs by a delicate larval membrane.

For want of time the crabs bearing the eggs were placed in alcohol and studied after my return to Salem. Hoping to get another opportunity to study the living embryos and larvæ, after waiting about ten years expecting that some of our carcinologists might describe the transformations of this interesting crab, I have decided to offer the following slight contribution to the subject, with the hope that a complete history of the development of the fiddler crab may yet be worked out.

Several eggs were observed in which one, two, or sometimes three large nucleated and nucleolated (blastodermic) cells (Fig. 1, *A*) were observed lying on the periphery of the egg; they were more or less flattened, and the yolk on which they rested was hollowed out under them. When the chorion is ruptured they pass out whole as large round cells *(d)*. Their large size seems unusual for polar blastodermic cells. They all appear to be, however, waste segmentation cells. In eggs farther advanced, and after the blastoderm has appeared, the yolk is seen to be surrounded by a distinct membrane.

In the next stages observed (*B*), the zoëa, with its appendages and large, dark, sessile eyes was formed. *(C*, the same freed from the egg shell or chorion.)

Upon rupturing the egg-membrane of the alcoholic specimens, I was enabled to work out the form of the larva just before hatching. The cephalothorax is large and spherical, not segmented, while the abdomen is long and slender, and composed of six definite somites; the last one ending in a forked tail, the rounded lobes provided each with three long setæ or bristles (*D*). I could detect no frontal or dorsal spine, though they were probably present in a rudimentary form. The antennæ are as represented at Fig. 1, I, II; the upper antenna (I) is conical, short and thick, without any terminal seta; while the second or lower antenna (II) is much slenderer, rather longer, and ends in four very unequal setæ, the second seta from above being very much the larger. The mandibles are simple, and I could detect no palpus. The first maxilla (IV) is two lobed, the lobes representing two endopodites; the upper (palpus) is about half as thick as the lower, and the seta hair-like; those of the first (lower) endopodite are spine-like. Of the second maxilla (V) only the three inner lobes or endopodites were observed, the exopodites or what corresponds to the gill and scraper of the adult crab, unfortu-

nately not having been worked out. The two maxillipeds (VI, VII) repeat each other in form; the basal joint giving rise to a simple

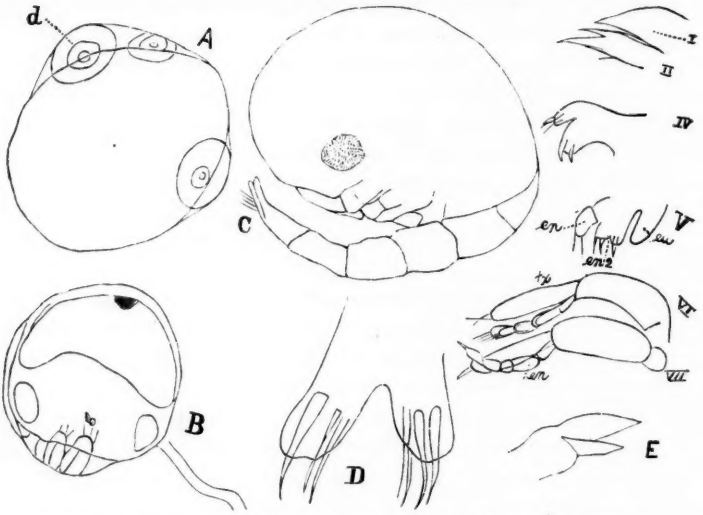


FIG. 1.—A–D, young of Fiddler Crab; E, abdominal leg of larval Alpheus.

exopodite (*ex*) and a four-jointed endopodite (*en*) in the first maxilliped, and a five-jointed one in the second. The new joints of the zoëa of the second stage and the first larval skin are to be seen in the figure.

Our knowledge of the zoëa forms of the crabs, or Brachyurous Decapoda is really quite limited, especially when we consider the first larval stage. Careful studies on the embryonic zoëa-forms only comprise those of Professor S. I. Smith and Mr. W. Faxon on the early stages of Hippa, those of Faxon and Professor Brooks on the early stages of Porcellana, and those of Faxon on the early stages of *Carcinus mænas* and *Panopæus sayi*. Now the zoëa of Porcellana, Hippa and Pagurus are, in the abdominal and other characters, quite different from those of the higher crabs, and approach those of the shrimps and other Anomura, and this is what we might expect, as these forms are intermediate between the shrimps and true crabs. It is a matter of considerable interest to learn something of the zoëa of Gelasimus, as with Ocypoda it stands at the head of the crabs, above Cancer, Carcinus, Panopæus, etc.

Comparing our Gelasimus larva, artificially removed from the egg, with Faxon's beautiful figures[1] (1, 2) of the embryonic zoëa of Carcinus shortly before hatching (his Fig. 9 representing the larva in the act of exuviating the larval skin);[2] the first antennæ are seen to be much shorter and proportionately stouter than in the remarkably developed antennæ of Carcinus, being more as in the zoëa stage; the second antennæ have nearly the same general form as in the zoëa after molting; the spine (exopodite), squamiform appendage (endopodite), and rudimentary flagellum being indicated. The antennæ of our embryo Gelasimus do not appear, then, to have the great development found by Faxon to exist in Carcinus of the same or nearly the same age. Faxon has not represented the first maxillæ, but it is two-lobed, the lower larger lobe probably being later in life differentiated into two endopodites; the second maxillæ differ from Faxon's figure of the embryonic zoëa of Panopæus in not being divided into four endopodites equal in size and form, but into three endopodites, the second (v *en*^{2}) being deeply lobed, and the third (v *en*^{3}) being two-jointed. They, however, are nearly identical in form with the second maxillæ of Cyclograpsus as figured by Müller.[3]

The endopodites of the first and second maxillipeds differ from those of Carcinus in having five joints, Carcinus having four joints to the endopodites of the first pair and only two in the second pair; in Cyclograpsus, however, Müller figures three, and as Gelasimus stands higher in the series than Cyclograpsus, it is possible that Gelasimus is, in this respect, more differentiated. (All of my drawings were made with the camera, though it is possible I may have been in error in drawing too many joints.)

The tail of our embryonic Gelasimus also shows no such extreme development as discovered in Carcinus by Faxon, and in this respect it is like Cyclograpsus (Müller's Fig. 18); and hence I am inclined to the supposition that Gelasimus before the first

[1] On some points in the structure of the embryonic zoëa. By Walter Faxon. Bulletin Mus. Comp. Zoology, VI, No. 10. Pl. II, Fig. 1.

[2] We see no reason for not homologizing this membrane with the amnion of insects and of Limulus and Apus.

[3] See Facts for Darwin. English translation, p. 50, Fig. 18. Our Gelasimus zoëa appears to agree much more closely with the zoëa of Müller's marsh crab (Cyclograpsus) than with that of Carcinus or Panopæus, but in Müller's figure the endopodites of the second pair of maxillipeds are drawn as three-jointed. His zoëa has a dorsal and frontal spine, and represents a more advanced stage than our Gelasimus embryo.

molt, after hatching, does not exhibit the strange and suggestive antennal and caudal features described by Mr. Faxon, and which he has interpreted so ably.[1]

An Abbreviated Metamorphosis in Alpheus heterochelis.—This species and *Alpheus minus* Say, are very abundant, living in the larger excurrent orifices of the large sponges which exist from the depth of one or two feet or more to deeper water, at Key West, Florida. *A. minus* is, however, far more abundant than the larger species. I found several of *A. heterochelis* with far advanced embryo, in the winter of 1869–70, and on removing the embryonic zoëa from the egg, was interested to find that the larva was of a form much more advanced than in the zoëa of other Anomoura described and figured by Fritz Müller in his suggestive work entitled "Facts for Darwin." Indeed the metamorphosis appears to be abbreviated, and the larva on hatching closely approximates the form of the adult, as in the case of the development of the lobster, the crawfish, and of *Palæmon adspersus* and *Eriphia spinifrons* (the three latter observed by Rathke). The eyes were developed on very short peduncles, being almost sessile. The embryo was near the time of hatching, though the yolk was not entirely absorbed. The two pairs of antennæ were well developed and hung down behind the large claws; the five pairs of legs were well developed, the joints distinct, and the first pair were about twice as thick as the others, the claws rather large, but not so disproportionately so as in the adult form, but as much so as in the larva in the second stage of the lobster, figured by Professor Smith. The eyes were large, but nearly sessile. The abdomen was broad and flat, spatulate at the end much as in the adult; there were five pairs of abdominal feet or swimmerets (Fig. 1 *E*), each with an endopodite and exopodite, like those seen in the second larval stage of the lobster.

[1] It was not until the greater part of this article was written that I saw that Mr. Faxon has raised *Gelasimus pugnax* from the egg for the express purpose of examining the embryonic cuticle, and that he has figured the forked tail of the first zoëa on his second plate, figure 11, which closely resembles that of the first stage of the zoëa of Carcinus. Had I noticed that he had studied the development of Gelasimus, I should not have attempted to write out my notes, but conclude to offer the remarks in this article subject to future corrections. Mr. Faxon does not state whether Gelasimus undergoes the sub-zoëal stage of Carcinus or not, and which our observations indicate do not probably exist. We would, in passing, suggest that the term sub-zoëa be applied to the zoëa before the amnion is thrown off, as it corresponds in a degree to the fleshy-hatched larva of the grasshoppers, myriapods and other Tracheata before the amnion is exuviated.

It thus appears that *Alpheus heterochelis* hatches in a stage more advanced than the first larval stage of the lobster. Unfortunately the specimens, though carefully preserved for several years, finally got misplaced, so that it is not possible for us to give a more detailed description of the young at the time of birth.

——:o:——

REASON—A PSYCHOLOGICAL DISTINCTION.

BY HARLEY BARNES.

FROM its peculiar sphere, psychology requires a very close and rigid discrimination in the use of words. A prevalent looseness in this respect is a prolific source of confusion and misunderstanding in the discussion of this and similar questions.

An article in the August NATURALIST, entitled "The Reasoning Faculty of Animals," contains a number of interesting facts showing that the lower animals have the power of "reason;" this term is defined as "the power by means of which one proposition is deduced from another, and of forming a conclusion from known premises." This is truly the faculty of reasoning—a part of the understanding—but reason, as understood by psychologists, comprehends far more than this. The classification used in the editorial on insanity in the same number, and now generally accepted, I believe, places all mental operations in three great classes: the intellect, the emotions and the will. Continuing this division according to Hickok and others, we have the powers of the intellect arranged in three very distinct groups, called the sense, the understanding and the reason. A few words of explanation will make the arrangement plain.

Sense is the name given to that operation of the intellect which forces a constant flow of perceptions upon the field of consciousness. These may be perceptions of the five (or six) senses, internal perceptions of our own feelings and emotions, or the vague creations of a wandering judgmentless fancy common to children, savages, inebriates and opium-eaters. All these perceptions flow in an unconnected, unceasing train across the mirror of consciousness, and are as momentary as the beating of sound-waves against the tympanum. This gives occasion for the second operation of the intellect, called the *understanding*, by which these separate perceptions are placed in their proper relation to each

other, giving ideas of definite, distinct substances, and of their reciprocal action in cause and effect. These operations, including the higher form of abstract reasoning, involve the use of the faculties of memory, reflection, association, abstraction, etc., and the formation of logical judgments.

The processes of the understanding, working upon the perceptions of sense, weave all the facts of nature into one endless chain of effects, each dependent upon its foregoing cause. In pursuing such a train of thought there can, of course, be no departure from the real and tangible; no approach to the unconditional—to the primal cause. There can be no conception of any power above nature because the understanding considers only natural facts for which it assigns natural causes; hence there can be no rising above the things known to the manner of knowing, nor above limited time and space to the Infinite, nor above conditioned power and truth and beauty and goodness to the Absolute. All these grander conceptions, distinct from judgments of the understanding in their scope, their creation, and the principles which underlie them, are the products of *reason*, the queen of the intellectual trinity and the vivifier of intellectual activity.

The lower animals have the power of sense, their perceptive faculties being often better developed than those of man, though usually not in so great a variety. They also have the power of understanding, to a variable extent; can learn from experience, reason from cause to effect, and by association of ideas; in some cases the memory is capable of considerable development. It is freely granted by all unprejudiced thinkers, I believe, that there is a possibility for the irresponsible animals to reach the very highest attainments of the understanding, though in every instance yet recorded they fall immeasurably below them. But beyond this limit they can never go; they are a part of nature and amenable to natural laws, mentally as well as physically; to modify Hamilton's famous conclusion, "the *animal* mind can never know the unconditioned." The animal mind can discover but can never invent; it can utilize and explain, but can never originate. It can have none of those thoughts commonly ascribed to morality, no appreciation of the beautiful, no knowledge of truth, no conception of the infinite and the absolute.

EDITORS' TABLE.

EDITORS: A. S. PACKARD, JR., AND E. D. COPE.

—— We publish to-day a short critique, by Mr. Harley Barnes, on Mr. James' article on animal reason, which appeared in the August NATURALIST. This gentleman maintains the characters of reason as distinct from the understanding. He defines the former as the power of invention as distinguished from discovery. The understanding "can utilize and explain, but not originate. It can have none of those thoughts commonly ascribed to morality, no appreciation of the beautiful, no knowledge of truth, no conception of the infinite and the absolute." All these qualities are ascribed to reason. We think that if this be the definition of reason, that we can show that the latter has no existence whatever. Thus we deny that man has any conception of "absolute" and "infinite." They are words which do not represent ideas, just as the statement "twice two equals six," relates to nothing either objective or subjective. They belong to Spencer's class of "pseudideas." As to the "knowledge of truth," anything correctly known by animal or man is truth, and animals know a good deal of it. The "appreciation of the beautiful" is well developed in many animals, more, it seems to us, than in some men. "Thoughts commonly ascribed to morality" apparently exist in some animals, especially the dog; while they are feebly developed in some races of savage men. The superiority of men is to be conceded here, but if morality be an attribute of reason, then traces of this reason are discoverable among some lower animals. The powers of origination and invention here ascribed to man and to reason, as distinguished from the "understanding" of the lower animals, even when most orignal, are of doubtful existence. They consist generally of combinations of a few first principles already learned through experience or confirmed by experience. Musical composition is probably derived from rhythmical movements of certain brain elements, which are favored by feeble vitality of the parts, and which are combined by the subject in selected ways.—*C.*

—— North America, from the Sierra Nevada to the Rocky mountains, inclusive, will doubtless lead the world in the production of silver and gold for a considerable time. Although the aggregate of the precious metals, hitherto abstracted, reaches an

enormous figure,[1] much more remains in the earth than has been taken out of it. Many good mines are only commencing their yield, while new ones are being discovered. Of course in a business where the profits are large, and the risks considerable, there will be numerous attempts to defraud the public. This may be done in various ways, and one of these is by so-called reports of would-be scientific experts. It is of first importance to persons desirous of investing in mining enterprises, that they should examine into the characters of the authors of these alleged "scientific" reports. In the investigation of the nature and value of mineral deposits, the most skillful specialists are liable to error, such are the difficulties of the subject. Yet there are companies who will publish statements from persons without knowledge or experience, and which are absolutely worthless, and often supremely ridiculous. Two notable examples of such publications have recently come under our notice. One of these, made to the Iowa Gulch Mining Co., on their property in Leadville, is a tissue of absurdities. Its author goes so far as to state that the strata dip at an angle of so many degrees "F" (? Fahrenheit). Another is the prospectus of "The Arizona and New Mexico Mining Co.," of which the Hon. E. Joy Morris is the alleged president. Several lists of mining claims are given, most of which are of little or no value, while the descriptive part of the "report" is confined to an enumeration of the productiveness of the mines of Mexico a century ago. The publication is flimsy in the highest degree, and no person of ordinary intelligence need be induced by it to part with any money.

Equally absurd, although with good intention, are the comprehensive denunciations of silver mining enterprises indulged in by a number of the newspapers of Philadelphia. On their side they display an ignorance of the subject equal to that of the so-called "experts" in question, and are in marked contrast to the press of New York and Boston, which are generally intelligent in their treatment of the business. As well denounce agriculture because some man could not raise potatoes on the Sahara, as repudiate silver and gold mining because some newspaper man has lost his money in a "wild cat."

[1] For the fiscal year 1879–80, the amount produced in this region was $75,206,000; see report of Supt. of U. S. Mint.

RECENT LITERATURE.

HYATT'S GENESIS OF THE TERTIARY SPECIES OF PLANORBIS AT STEINHEIM.[1]—It sometimes occurs to the active student of biology, when wearied with the multiplicity of details, the almost endless species and varieties of the groups he may be making his specialty, to inquire what is the use of this great expenditure of time and mental effort, when the actual result of years of labor and research may be to add but one stone to the foundation of facts underlying the superstructure which others abler than he or his successors, may build up; or if he be synthetic in mental disposition, and capable of adding a well founded, sound generalization as the fruit of the years of his labors as a collector and discoverer of facts, what a slight contribution after all is his new "law" or induction to what is really needed to establish a philosophy of life! The earnest naturalist who desires to make a permanent solid contribution to his science, is animated with the wish to attempt, at least, a solution of two problems: What is life? and second, How did life originate? These problems are or should be the sources of inspiration, the goal to which all his effort tends. The first question may never be solved, though the attempt has been and always will be made; the second may be within the scope of the human intellect, and we may, with some confidence, hope for a solution which will appeal to the understanding of every candid naturalist, and ultimately command the assent of every philosophical mind.

The obvious method of inquiry in the discovery of the laws of evolution is to ascertain the effect upon organisms of nature and life about them, and the mutual relations of the organisms themselves. This is beginning at the bottom of the matter; and the attempts in this direction will in the long run, it seems to us, bring deeper-reaching, truer and more logical results, than by confining the attention alone to the secondary, more superficial study of variations and effects of natural selection. Mr. Darwin has, by his genius, industry and simple, popular mode of presentation of the doctrine of natural selection, produced a revolution in scientific thought. He has sowed the seed and prepared the way for more profound, thorough going views as to the origin of life-forms.

The work of Professor Hyatt before us, as well as his earlier papers on the origin of forms among the Ammonites, which have been noticed in the earlier volumes of this journal, are important contributions to the evolution hypothesis. These essays, together with those of Professor Cope on the origin of genera (1861), and his later papers on the law of acceleration and retardation, with the briefer, more fragmentary writings of other Ameri-

[1] *The Genesis of the Tertiary Species of Planorbis at Steinheim.* By ALPHEUS HYATT. (From the Anniversary Memoirs of the Boston Society of Natural History. Boston, published by the Society, 1880. 4to, pp. 114, with 9 plates.)

can naturalists, have resulted in a distinctive American school of evolutionists, if we may venture so to style it. Cope and Hyatt each working quite independently of the other, and in different branches of the animal kingdom, have arrived at the conclusion that species and genera may be both slowly, and sometimes suddenly produced through the action of the environment upon the animal or plant, producing a tendency to variation, after which the action of the laws of heredity, checked by natural selection, legitimately produced their results.

It is not our present purpose to make an exposition of Cope and Hyatt's views, but referring the reader to their essays and articles, to give in this review the results of Professor Hyatt's studies on the evolution of the Steinheim fossil snail-shells. These Tertiary fresh water shells occur in great abundance and variety of form and individuals in clay pits at Steinheim, near Stuttgartt. The shells lived in a Miocene pond or lake more or less shut in from any other waters. Attention was first called in 1866, in a brief paper by Dr. Hilgendorf, to the shells in these beds, and the light they threw upon the evolution theory, which led Professor Hyatt, in 1872, to collect these shells in large numbers, and to make an independent examination of them. The shells all belong to the genus Planorbis, and the numberless varieties and forms taken from the beds, appear to be lineal descendants of four varieties of a single ancestral species *(Planorbis levis)*, found in the lowermost beds deposited at the bottom of the lake. The inhabitants of these beds were not necessarily evolved through a vast period of time (as in general demanded by Darwinians) but Hyatt states that Professor Cope's researches among fishes and reptiles, his own among Ammonites, and at a later date Mivart's work on the "Genesis of Species," have all given a large amount of evidence, which tends to the conclusion "that vast periods of time are not necessarily essential to the production of new species, or even new generic or family forms."

Hyatt considers that the normal, smooth, primordial form *(Planorbis levis)* lived in neighboring Miocene lakes, and, before its migrations into the Steinheim lake, had four varieties, and subsequently reproduced these or their immediate descendants in the Steinheim lake. Four principal series were developed from these four varieties after their migration into the Steinheim lake, and while the original forms in the first series or line of descent had the closest relationship with each other, their descendants gradually diverged, until finally no hybrids connected the different series with each other. The first series culminated in variously keeled forms, and finally ending in an untwisted corkscrew-like form; the second series preserved the smooth normal form; the third series finally assumed a heavy, somewhat angular and rather large form, while the fourth series terminated in large, heavy, conical forms, the last one having a high spire very unlike

Planorbis and more like a Paludina in its general shape. It should be borne in mind that the forms belonging to the first series were connected by hybrids, and the whole series "presents to the ordinary observer a chaos of similarities and differences."

Referring our readers to the paper itself for details and illustrations, we may, without further delay and without criticising the author's mode of research, except to say that the time and patience spent upon the work, and the author's evident candor and accuracy, lead us to accept his results as sound inductions, now quote the conclusions of this elaborate memoir.

(1) The extraordinary modifications and series of shells found at Steinheim are in one way exceptional, and owe their existence to exceptional conditions.

(2) These conditions appear to be the isolation of the modified descendants of *Planorbis levis*, due to the absence of competing types, and the character of the environment.

(3) This environment was suitable for the propagation and perpetuation of the distinctive peculiarities of their series, and unfavorable in various degrees to those of the sub-series of the first series.

(4) That while the perpetuation and survival of the differential characteristics can be thus accounted for, we must look to other causes for the production of the parallel forms and the regularity of succession of these forms, as shown in the arrangement in the different series, and in the development of the individual.

(5) That this cause lies in some law of growth and heredity which reacts against the tendency of the physical environment to produce variations and differences, and produces parallelism in the development of different individuals of the same species, of different species in the same series, and in the succession of forms in the different series, and also limits the tendency to variation within definite boundaries in the species, especially in *Planorbis levis*.

(6) That while the influence of the environment must be admitted as paramount in exceptional instances, it for the most part produces these exceptions in extreme cases of parasitism, and the Steinheim shells are not parasites, and cannot be assumed to have been under similar influences in respect to the laws governing the size and genesis of the series, they ought, therefore, to come under the same laws as other forms occurring in other localities.

(7) That this appears to be the case except in so far as they are a very limited group, confined to a very limited field, a field free from competition, and extremely favorable to their growth for that and other reasons.

Professor Hyatt next inquires, "what is this law of heredity and growth which maintains the type, causes parallelisms and constrains variation under ordinary conditions, but still, in certain cases, is forced to give way to physical influences.

"Ruling out the lost or transient forms which are not perpetuated, we see that the fundamental law here, as elsewhere, is, that all the characteristics are inherited after they are once introduced.

"In former essays, especially written for this purpose, I have tried to show that there was such a general law which is so plain and simple that I have wondered that no authors have made it the basis of investigation except Professor Cope and myself. In every series of animals which I have studied, the same fact appears, namely, that in a given number of generations, inherited characteristics of every kind tend to appear in the descendants at earlier stages than that at which they first occurred in the ancestral forms. Whether characteristics are normal or abnormal, provided they are fixed in the race either by the action of natural selection or by the direct working of physical causes, they are inherited according to this law.

"The law of acceleration appears to me, at present, to show the manner in which characteristics, which are perpetuated, finally either disappear or become fixed in the young, or even in embryo. This conclusion may be followed out by any one who will arrange a series of animals or their shells, according to their adult affinities and their developmental characteristics. He will then see that adult characteristics which are introduced in ancestral forms, tend to reappear at earlier and earlier stages, as he travels along the series."

MAREY'S ANIMAL MECHANISM.[1]—Although the main principles and facts contained in this interesting volume have been already given to the public by way of abstracts in scientific journals, yet it is not too late to call the attention of zoölogists to the value of this work in their studies. Animal mechanics has been much neglected from the difficulties of the subject. The practical bearings are, however, of great importance, for if we knew under what conditions the maximum of speed, force or labor which man either singly or in armies could furnish, might be obtained, a general would know how much of a load a soldier could carry, while if we knew exactly at what pace an animal does the best work, whether he be required for speed or for drawing loads, we could all be Mr. Bergs and prevent much suffering in our noblest of animals, the horse, and that only less useful creature, the ox; while in the good time coming, when electricity may serve as the motive power instead of steam, animal mechanics will reach its apotheosis in a flying machine adapted to the wants of our everyday life, as well as of the traveler, soldier, and all whose calling may impel them to seek a means of locomotion in rapid aerial transit.

[1] *The International Scientific Series. Vol. xi. Animal Mechanism:* a Treatise on terrestrial and aerial Locomotion. By E. J. MAREY, Professor at the College of France, etc., with 117 illustrations. New York, D. Appleton & Co., 1879. 12mo, pp. 283. $1.75.

Our more immediate purpose in noticing this book, has been to call the attention of our zoölogical readers to the chapters on animal motion and electricity in animals, on the harmony between the organ and the function, involving the acceptance of the development hypothesis, and finally the excellent and suggestive chapter on the variability of the skeleton.

After discussing the origin of heat, of mechanical work, and of electricity in the animal kingdom, in order to establish clearly that these forces are the same as those which are seen in the organic world, the author proceeds to study mechanical force, and more especially to follow it through all it applications to work of different kinds which it executes in an animal. Marey adopts the old comparison between an ordinary machine and the animal, the organs of the latter corresponding to the parts of the machine, and then he insists on the strict relations existing between the form of the organs and the character of their functions; he farther maintains that this correspondence is regulated by the ordinary laws of mechanics, "so that when we see the muscular and bony structure of an animal, we may deduce from their form all the characters of the functions which they possess." He notices the fact that in the kangaroo, essentially a leaping animal, there is an enormous development of the muscles of leaping, the *glutei*, the *triceps extensor cruris*, and the gastrocnemial muscles. In birds the function of flight is exercised under very different conditions in different species; so also the pectoral muscles, which move the wings vary greatly in different birds. For example, birds which have a large surface of wing, as the eagle, gull, tern, &c., give strokes of only a slight extent; that depends on the great resistance which a wing of so large a surface meets with in the air. Those birds, however, which have small wings, as the guillemot and the pigeon, move them to a great extent. "If it be admitted that the first mentioned birds must make energetic but restricted movements, and that the second must move with less energy, but with greater amplitude of stroke, the conclusion arrived at must necessarily be that the first ought to have large and short pectoral muscles, while in the second, these muscles should be long and slender." This is proved, says Marey, by a simple inspection of the sternum in different species; "for this bone measures in some degree the length of the pectoral muscles which are lodged in its lateral cavities. Thus birds with long wings have a wide and short sternum; the others have one which is long and slender." "We might multiply," says our author, "indefinitely, examples which prove the perfect harmony between the form of the muscles and the characters of their functions. Everywhere the transverse development of these organs is associated with strength, as in the triceps of the kangaroo, or the masseters of the lion; everywhere also, the length of muscle is connected with the extent of movement, as in the examples which we have just

cited." Now, inquires Marey, is this harmony preëstablished, or rather is it formed under the influence of function in different creatures? Just as we see muscles increase in volume by use, so we may observe them, under the influence of more extended movements, acquire a greater length. "Can we see a displacement of the tendinous attachments of the muscles to the skeleton, under the influence of changes in the force of muscular traction? This problem he proposes to settle by experiment, but before doing so he feels obliged to invoke the development theory, and to show that all through nature, and even in medical science, when an organism, as also an organ, is placed under new circumstances it must change in form, and that "function makes the organ." His philosophy is a substratum of Lamarckianism, *i. e.*, change in the environment ensuring change in the organ and in the organism; with a superstructure of Darwinism, or natural selection, acting after a change or variation has been induced. The application of these views is seen in chapter IX, Variability of the Skeleton, an essay of great interest from the point of view of the laws underlying the sciences of comparative anatomy and palæontology.

Professor Marey shows in this chapter how yielding in its nature is the bony system of the vertebrates during life; that pressure or tension, however slight, will produce the strangest changes of form; the bone, he goes so far to say, is "like soft wax which yields to all external forces," and we may say of the skeleton, that "its form is that which the soft parts with which it is surrounded permit it to assume." He cites cases in surgery and medicine, as well as comparative anatomy, in proof of the proposition "that in the form of the bony structure, everything bears the trace of some external influence, and particularly of the function of the muscles. There is not a single depression or projection in the skeleton, the cause of which cannot be found in an external force, which has acted on the bony matter, either to indent it, or draw it forward."

The great variety of forms in the skeletons of different animals corresponds with the diversity of their muscular systems. Now if the muscles modify the bones, what brings about the various changes in form of the muscles? Marey attempts to demonstrate that the power to which the muscular system is subjected belongs to the nervous system. "The nature of the acts which the will commands the muscles to perform, modifies the muscles themselves, in their volume and their form, so as to render them capable of performing these acts in the best possible manner." The author, from facts in medicine and surgery, shows that it is movement or use which maintains the existence of the muscle; after paralysis or dislocation of bones rendering muscles useless, a muscle may wholly disappear, undergoing either fatty degeneration or fibrous transformation.

With these principles in view, and guided by them, our author then discusses with great originality, and chiefly by the experimental method, locomotion in general, that of man and the horse, and finally the flight of insects and of birds.

PEIRCE'S IDEALITY IN THE PHYSICAL SCIENCES.[1]—It is commonly said by pulpit orators and metaphysicians of the transcendental school, that physical science is lowering and materialistic, that it is concerned with facts alone, and physical, material laws, and that its study tends to deaden the finer sensibilities of the mind and to weaken the grasp of the intellect. How incorrect such a notion is, every thinking scientist realizes; his mind, observant of facts in nature, is continually on the alert, endeavoring to ascertain the meaning of those facts; he is constantly rising from the seen to the unseen; from the actual to the ideal. The late Professor Peirce, whose life was devoted to the study of mathematics, to dry computations carried on year after year, in these posthumous lectures, tells us in impassioned, eloquent words, which every scientist should read, that facts organized into theory "ascend to the very throne of ideality." And if the highest researches of the mathematician are especially transcendental, how much more ideal and transcendental, we would add, become the researches of the biologist, who is concerned with the elusive and subtle laws of life and the mental and spiritual forces of man. No wonder, for example, that the thinking world is profoundly moved by the ideas suggested by evolutionists, and by the study of the origin of things material, for these problems touch upon the deepest, most insoluble problems of man's nature.

The general student of geology and biology will also read this fascinating volume for the sake of the author's views regarding the nebular hypothesis and general cosmogony. Professor Peirce may be regarded as one of the founders of the nebular hypothesis in its modern form. In this book he guides us through the successive steps in nebular history—from chaos to nebula, from nebula to star, and from star to planet.

The author in beginning his exposition of the nebular hypothesis, regards the first chapter of Genesis, rightly interpreted, as "a profound cosmogony. It may not be the revelation of an actual fact, but it teaches where that revelation is to be found; that it is engraved on stone by the all-wise Author; that it is written in the sun, moon and planets; that it is inscribed on the sidereal universe, and that every star is an oracle of God." Coming to the nebular theory, the author treats of nebulosity, of a nebula proper, a cluster, the Milky Way, the Magellanic cloud, of an annular nebula and a spiral nebula; then of the star, and finally the planet, comet and meteor. Geologists will be interested in this philosopher's views as to the cooling of the earth and the

[1] *Ideality in the Physical Sciences.* By BENJAMIN PEIRCE. Boston, Little, Brown & Co., 1881, 12mo, pp. 211.

sun. After a discussion of Thompson's views upon the cooling of the earth, the author gives his reasons for not accepting his explanation of the process of solidification, with its corresponding limitation of the geological ages. Peirce believed that there was a permanent superficial solidification at an exceedingly early stage of the process, together with the formation of an interior solid nucleus. "These interior and exterior solid portions will be separated by a liquid stratum, which is ever decreasing in thickness, to supply the increasing solidity above and below it." Hence the larger portion of the earth's interior being liquid, the earth must have become solid in a vastly greater length of time than Thompson supposes, "and no physical obstacle can mathematically be interposed to embarrass the researches of geologists, to interfere with their ages of erosion, and to diminish the possibility of an increased duration of organic life."

Turning then to the current view that the sun is not more than 20,000,000 years old, our author believed that by computation the age of the sun may have been twenty-five times greater than the estimates of some distinguished astronomers and physicists.

The concluding chapter on potentiality is replete with suggestions by a Christian philosopher for arguments for the existence of a Creator and the immortality of the soul; and the volume is well worth reading, not only for the invaluable exposition of the nebular hypothesis, but as a proof that the legitimate results of speculative evolutionary science tends to demonstrate the existence, outside of the material world, of a Creator and of a spiritual world, where the soul of man, "whose only life is action," freed of its physical scaffolding, however important in the beginning, may hereafter engage in ceaseless intellectual as well as spiritual activities.

New England Bird Life.[1]—There has never been published anything like a complete exhibition of New England bird-life. Samuels' work,[2] the first attempt at it, was very successful as a popular ornithology, but was hardly worthy of its success; while Minot's later volume,[3] meant for a substitute, was incomplete, designedly omitting all the water-birds, and seemed to many wanting in precision and authority. The last work, just published (its title is given below), is by Mr. Winfrid A. Stearns, son of the late President of Amherst College. It should be welcomed as a concise, clear and careful summary of our knowledge of New England birds. In freshness, and individuality, and fullness it may seem wanting, though not in occasional picturesqueness. As a di-

[1] *New England Bird Life, a Manual of New England Ornithology.* By Winfrid A. Stearns. Revised and edited by Dr. Elliott Coues. Published by Lee & Shepard of Boston, and Charles T. Dillingham of New York. Part 1. Oscines (1881): pp. 324, illustrated. $2.50.

[2] "Ornithology and Oölogy of New England." By Edward A. Samuels. (1867.)

[3] "Land-birds and Game-birds of New England. By H. D. Minot. (1876–77.)

gest and a manual it has no equal. How much of its value is due to its very able editor, does not appear. His interpolations, however, are too often personal rather than ornithological. The physical features of the volume are all satisfactory, except the numerous illustrations, all borrowed, and many of them too old for further use. The contents are: an introduction, with suitable information on structure, and on the preparation of specimens, and with very satisfactory presentation of faunal areas and of special bibliography; next, somewhat brief descriptions of the birds and of their lives, all systematically arranged; and finally, two *indices*. The copious references to particulars of evidence, are an admirable characteristic. The present part includes the song-birds only (technically, *Oscines*). A continuation and completion, in a second volume, is promised by the publishers. Our hopes, so often disappointed, of a good popular work on our water-birds, are again animated. Why cannot Mr. Stearns fulfill them, with additional credit to himself, and pleasure to the public?—*H. D. M.*

BRONN'S CLASSES AND ORDERS OF THE ANIMAL KINGDOM, CRUSTACEA.—Geistaecker's great work on the Crustacea has reached the first three numbers of the second part, on the Malacostraca, and begins with the Isopods, treating of them in the same general manner as the Entomostraca and other lower Crustacea. Some ninety pages are devoted to an account of the organization of this group, the subject not being completed at the end of the third number. The eight closely crowded plates are well drawn. When this series is completed it will form a library in itself.

INDEX TO RILEY'S NINE REPORTS ON THE INSECTS OF MISSOURI.[1]—The nine reports of Professor Riley on the injurious insects of Missouri, were perhaps the most valuable series of State entomological reports ever issued, consisting largely of original matter with most excellent illustrations; and as they have long been out of print, this index and supplement will be useful for reference, as all of the descriptions of new species are reproduced with notes and additions.

RECENT BOOKS AND PAMPHLETS.—On the Cynipodous galls of Florida. By William H. Ashmead. From the Monthly Proceedings Entomological Section Academy Natural Sciences Philadelphia, 1881. Paper No. 1, pp. IX–XIV; Paper No. 2, pp. XV–XX. From the author.

On the number of molts of butterflies, with some history of the moth Callosamia promethea. By William H. Edwards. From Psyche, Vol. 3, No. 81, pp. 159–161. From the author.

Annual Report of the Entomological Society of the Province of Ontario for the year 1880. Toronto, 1881, 8vo, pp. 89. From the society.

Note sur deux Société's d'horticulture aux Etats-Unis. Par M. V.-Ch. Joly. From Journal de la Soc. nation. d'Hortic., 3e série, III, 1881, p. 261–271. From the author.

[1] *Department of the Interior, U. S. Entomological Commission.* Bulletin No. 6. General Index and Supplement to the nine reports on the Insects of Missouri. By CHARLES V. RILEY. Washington, March 24, 1881. 8vo, pp. 177.

Berliner Entomologische Zeitschrift. Herausgegeben von dem Entomologischen Verein in Berlin. 25ter Band (1881), erstes Heft. From the society.

Some characters useful in the study of the Sphecidæ. By W. H. Patton. From the Proceedings Boston Society Natural History, Vol. XX, January 21, 1880, pp. 378–385. From the author.

List of the North American Larridæ. By W. H. Patton. L. c. pp. 385–397. From the author.

Notes on the Philanthinæ. By W. H. Patton. L. c. pp. 397–405. From the author.

Synopsis of the Lampyridæ of the United States. By John L. LeConte, M.D. From the Transactions American Entomological Society, Vol. IX, 1881, pp. 15–72. From the author.

On Pieris bryoniæ Ochsenheimer, and its derivative forms in Europe and America. By W. H. Edwards. From Papilio, Vol. I, No. 6, pp. 83–99. From the author.

Revision of the species of Polyphylla of the United States. By George H. Horn, M.D. From Trans. Am. Entom. Soc., Vol. IX, 1881, pp. 73–76, From the author.

Notes on Elateridæ, Cebrionidæ, Rhipiceridæ and Dascyllidæ. By George H. Horn, M.D. From Trans. Am. Entom. Soc., Vol. IX, 1881, pp. 76–90, tables I and II. From the author.

Geological Survey of Alabama. Reports of Progress for 1879 and 1880. By Eugene A. Smith, Ph.D., State Geologist. 8vo, pp. 158. Montgomery, Ala., 1881. From the author.

Catalogue of the Phænogamous and Vascular Cryptogamous Plants of Michigan, Indigenous, Naturalized and Adventive. By Charles F. Wheeler and Erwin F. Smith. Lansing, 1881. 8vo, pp. 105. From Erwin F. Smith.

Description of the preparatory stages of Papilio palamedes Drury (calchas Fab.). By W. H. Edwards. From Can. Entom., Vol. XIII, No. 6, pp. 119–123. From the author.

Effect of cold applied to chrysalids of Limenitis disippus. By William H. Edwards. From Psyche, Vol. III. No. 82, p. 174. From the author.

Agricultural advancement in the United States. By C. V. Riley, M.A., Ph.D. An address read at the organization of the American Agricultural Association. From the author.

Descriptions of some new Tortricidæ, by C. V. Riley, M.A., Ph.D. Trans. St. Louis Ac. of Sc., Vol, IV., No. 2, April 28, 1881.

Beiträge zur Paläontologie von Osterreich-Ungarn und den Angrenzenden Gebieten (V. Uhlig. Die Jurabildungen in der Umgebung von Brünn. Zweite Abtheilung mit Taf. XVI–XVII. Alois v. Alth. Die Versteinerungen des Nizniower Kalksteines. Erste Abtheilung mit Tafel XVIII–XXI. Herausgegeben von E. v. Mojsisovics und M. Neumayr. Ausgegeben am 20 Juli, 1881. 4to, pp. 68, 7 plates. Wien, 1881. From the editor.

Palæontographica. Beiträge zur Naturgeschichte der Vorzeit. Achtundzwanzigster Band oder dritte Folge Vierte Band. Erste Lieferung. Herausgegeben von Wilhelm Dunker, Professor in Marburg, und Karl A. Zittel, Professor in München, unter Mitwirkung von W. Benecke, E. Beyrich, Freiherrn von Fritsch, M. Neumayr und Ferd. Römer, als Vertretern der deutschen geologischen Gesellschaft. Inhalt Dr. Edmund Naumann, über Japanische Elephanten der Vorzeit, S. 1–40, Taf. I–VII. 4to, pp. 40, 7 plates. Cassel, 1881. From the editor.

Palæontographica. Beiträge zur Naturgeschichte der Vorzeit. Achtundzwanzigster Band oder dritte Folge Vierter Band. Zweite Lieferung. Herausgegeben von Wilhelm Dunker, Professor in Marburg, und Karl A. Zittel, Professor in München, unter mitwirkung von W. Benecke, E. Beyrich, Freiherrn von Fritsch, M. Neumayr und Ferd. Römer, als Vertretern der deutschen geologischen Gesellschaft. Inhalt Dr. Max Schlosser, die Fauna des Kelheimer Diceras-Kalkes. I. Abtheilung: Vertebrata, Crustacea, Cephalopoda und Gastropoda. S. 41–110, Tafel VIII–XIII. 4to, pp. 64, 6 plates. Cassel, 1881. From the editors.

Mittheilungen Des Vereins Für Erdkunde zu Halle a. S. 1877–8–9–80. 8vo, pp. 398, 2 plates. Halle, 1881. From the society.

Dr. H. G. Bronn's Klassen und Ordnungen des Thier-Reichs, Wissenschaftlich dargestellt in Wort und Bild. Fortgesetzt von Dr. A. Gerstaecker, Professor an der Universität zu Greifswald, Mit auf Stein gezeichneten Abbildungen. Fünfter Band, II Abtheilung. Gliederfüssler: Arthropoda 1, 2, und 3 Lieferung. Roy. 8vo, pp. 96, 8 plates. Leipzig und Heidelberg, 1881. From the editor.

Dr. H. G. Bronn's Klassen und Ordnungen des Thier-Reichs, Wissenschaftlich dargestellt in Wort und Bild. Fortgesetzt von C. K. Hoffmann, Doctor der Medicin und Philosophie, Professor in Leiden. Mit auf Stein gezeichneten Abbildungen. Sechster Band. III Abtheilung. Reptilien 18, 19, 20 und 21, Lieferung. Roy. 8vo, pp. 127, 8 plates. Leipzig und Heidelberg, 1881. From the editor.

Bulletins de la Société d'Anthropologie de Paris, Tome Troisième (III série), ze Fasciciule Avril à Juillet, 1880. 8vo, pp. 159. Paris, 1880. From the society.

Société Malacologique de Belgique Procès-Verbal de la Séance du 3 Avril, 1880. Séance du 2 Octobre, 1880. 8vo, pp. 50. 1881. From the society.

Sur l'Arc Pelvien chez des Dinosauriens de Bernissart. Par M. G.-A. Boulenger. Rapport de M. P.-J. Van Beneden. 8vo, pp. 8. Brussels, 1881. From the author.

De la Nomenclatur des Étres Organises Société Zoologique de France. Au siege de la Société. 8vo, pp. 38. Paris, 1881. From the society.

Bulletin de la Société Zoologique de France pour L'année 1881. 1re & 2e Porties Séances de Janvier–Avril. 8vo, pp. 80, 1 plate. Paris, 1881. From the society.

Note sur les Poissons Fossils D'eusse-Drome. Clupea Fontannesi, n. sp. Par M. H. E. Sauvage. Roy. 8vo, pp. 6, 1 plate. Paris, 1881. From the author.

Di Nuovo sui lavori del geologico nelle Alpi Apuane. C. De Stefani. Estratto del processo verbale della Societá di Scienze Naturali Aduranga del di 13 Marzo, 1881. 8vo, pp. 8. 1881. From the author.

Anales del Museo Nacional de México. Tomo II. Entrega 4a. Sumario.

Códice Meneazino; Ensayo de descifracion georgifica. Por el Sr. D. Manuel Orozcay Berra. (Continuacion.)

La Piedra de Sol; Estudio argueologico. Por el Sr. D. Alfredo Chavero. (Continuacion.)

Geologio, Noticias geologicas de algunos Caminos Nacionales. Por el Sr. D. Mariano Bárcena.

Mitos di los nahoas. Por el Director del Museo.

Dos antiguos monumentos de arguitectura Mexicana. Illustrados por el P. Pedro Jose Márquez. Traducido pora los "Anales del Museo." Por F. P. T. 8vo, pp. 80, 3 plates. Mexico, 1881. From the director of the National Museum.

On the Structure and Development of the Skull in the Batrachia. Part III. By William Kitchen Parker, F.R.S. 4to, pp. 268, 44 plates, colored, and cuts. From the Philosophical Transactions of the Royal Society, Part 1, 1881. London, 1881. From the author.

A Blastoid found in the Devonian Rocks of Ontario. By Henry Montgomery. 8vo, pp. 4, cuts. Extract from the Canadian Naturalist, Vol. x, No. 2. Montreal, 1881. From the author.

——:o:——

GENERAL NOTES.

BOTANY.[1]

CARUEL'S NEW SYSTEM OF PLANTS.—In the last number of his *Giornale Botanico Italiano*, Caruel proposes a system of plants which contains so many interesting points that it will be profitable to reproduce it here in a condensed form. He recognizes five grand divisions, viz: Gymnogamæ, Bryogamæ, Schistogamæ,

[1] Edited by PROF. C. E. BESSEY, Ames, Iowa.

Prothallogamæ and Phanerogamæ. The first is equivalent to the Thallophyta of many German botanists, but is treated very differently by the author. The Myxomycetes are very properly placed at the lower end of the division, in a separate class, the Plasmodieæ. In accordance with the rapidly growing idea first brought out by Cohn, the chlorophyll-bearing and chlorophyll free plants are not separated as Algæ and Fungi; and the lichens are considered an order constituting with the Sphærideæ and Gymnoascideæ the cohort Angiosporatæ, the latter very nearly equivalent to the Ascomycetes of botanists. The radical error, as it appears to us, in Caruel's disposition of the plants of the class Thallodeæ consists in making use of the asexual reproductive bodies in characterizing the sub-classes. Conidia and zoöspores at least, and almost certainly the tetraspores also (chains of four conidia?), are homologues, whose differences are related to differences in the habitat of the plants producing them. Conidia (if we except tetraspores) are aerial, while proper zoöspores are aquatic.

The position assigned to the Characeæ is scarcely a tenable one. They are too nearly related to the Floridiæ, and too distantly to the ferns to warrant placing them between the Bryogamæ and Prothallogamæ.

The separation of the Phanerogamæ into three classes will strike every one as an innovation of doubtful value. Why the orthography of Gymnospermæ should be changed to Gynospermæ, is also to be questioned. It will be observed that the cohorts and orders of the Angiospermæ rank higher respectively than do the groups bearing these names in the system most in vogue in this country: the families (omitted for want of space) in Caruel's system, are almost the equivalents of the orders of Bentham and Hooker, while Caruel's orders are nearly equivalent to Bentham and Hooker's cohorts.

Division GYMNOGAMÆ.

Class PLASMODIEÆ.

Cohort *Plasmodiatæ.*

Order Myxomycetes; Fam. Ceratiaceæ, Trichiaceæ.

Class THALLODEÆ.

Sub-class SCHIZOSPOROPHORÆ.

Cohort *Schizosporatæ.*

Order Nostochideæ; Fam. Chroococcaceæ, Oscillariaceæ, Nostocaceæ, Rivulariaceæ, Scytonemaceæ.

Sub-class CONIDIOPHORÆ.

Cohort *Gymnosporatæ.*

Order Puccinideæ; Fam. Sporotrichaceæ, Fusariaceæ, Stilbaceæ, Trichodermaceæ, Ustilaginaceæ, Pucciniaceæ.

Order Agaricideæ; Fam. Exobasidiaceæ, Tremellaceæ, Agaricaceæ, Lycoperdonaceæ.

Cohort *Angiosporatæ.*

Order Gymnoascideæ; Fam. Gymnoascaceæ.

Order Sphærideæ; Fam. Helvellaceæ, Sphæriaceæ, Erysiphaceæ, Tuberaceæ.

Order Lichenideæ; Fam. Myriangiaceæ, Verrucariaceæ, Parmeliaceæ.

Sub-class ZOOSPOROPHORÆ.

Cohort *Euzoosporatæ.*

Order Ulvideæ; Fam. Cladophoraceæ, Ulvaceæ, Sphacelariaceæ, Sporochnaceæ.

Cohort *Zygosporatæ.*

Order Pandorinideæ; Fam. Botrydiaceæ, Pandorinaceæ, Ulotrichaceæ.

Order Zygnemideæ; Fam. Diatomaceæ, Desmidiaceæ, Zygnemaceæ.

Order Peronosporideæ; Fam. Mucoraceæ, Chytridiaceæ, Peronosporaceæ, Saprolegniaceæ.

Cohort *Oosporatæ.*

Order Vaucherideæ; Fam. Monoblepharidaceæ, Volvocaceæ, Vaucheriaceæ, Sphæropleaceæ, Œdogoniaceæ, Coleochætaceæ.

Order Fucideæ; Fam. Ectocarpaceæ, Fucaceæ.

Sub-class TETRASPOROPHORÆ.

Cohort *Tetrasporatæ.*

Order Pseudoflorideæ; Fam. Porphyraceæ, Dictyotaceæ.

Order Florideæ; Fam. Ceramiaceæ, Nemaliaceæ, Lemaneaceæ, Sphærococcaceæ, Melobesiaceæ, Rhodomelaceæ.

Division BRYOGAMÆ.

Class MUSCINEÆ.

Cohort *Muscineæ.*

Order Hepaticæ; Fam. Anthocerotaceæ, Ricciaceæ, Targioniaceæ, Monocleaceæ, Marchantiaceæ, Jungermanniaceæ.

Order Musci; Fam. Andreæaceæ, Phascaceæ, Sphagnaceæ, Bryaceæ.

Division SCHISTOGAMÆ.

Class PUTERÆ.

Cohort *Puterœ.*

Order Puteræ; Fam. Characeæ.

Division PROTHALLOGAMÆ.

Class ISOSPOREÆ.

Cohort *Isosporeæ.*

Order Filicariæ; (1) Sub-order Trichosporangiæ; Fam. Hymenophyllaceæ, Polypodiaceæ, Gleicheniaceæ, Osmundaceæ.

(2) Sub-order Phyllosporangiæ; Fam. Marattiaceæ.

(3) Sub-order Ophiosporangiæ: Fam. Ophioglossaceæ.

Order Calamariæ; Fam. Equisetaceæ.

Order Conariæ; Fam. Lycopodiaceæ.

Class HETEROSPOREÆ.

Cohort *Heterosporeæ.*

Order Phyllocarpariæ; Fam. Selaginaceæ, Isoetaceæ.

Order Rhizocarpariæ; Fam. Salviniaceæ, Marsiliaceæ.

Division PHANEROGAMÆ.

Class GYNOSPERMÆ.

Cohort *Coniferæ.*

Order Strobiliforæ; Fam. Cycadaceæ, Pinaceæ, Taxaceæ, Gnetaceæ.

Order Coniforæ; Fam. Welwitschiaceæ.

Class ANTHOSPERMÆ.

Cohort *Dendroicæ.*

Order Spermiforæ; Fam. Viscaceæ, Loranthaceæ.

Class ANGIOSPERMÆ.

Sub-class DICOTYLEDONES.

Cohort *Dimorphanthæ.*

Orders Julifloræ, Globifloræ, Clavifloræ, Urticifloræ, Euphorbifloræ, Begonifloræ.

Cohort *Monochlamydanthæ.*

Orders Nudifloræ, Involucrifloræ, Ranifloræ, Cactifloræ, Cynifloræ, Daphnifloræ.

Cohort *Dichlamydanthæ.*

Orders Cirrifloræ, Myrtifloræ, Lythrifloræ, Rosifloræ, Tiliifloræ, Crucifloræ, Rutifloræ, Ericifloræ, Primulifloræ, Celastrifloræ, Umbellifloræ, Oleifloræ, Campanifloræ, Asterifloræ, Corollifloræ.

Sub-class MONOCOTYLEDONES.

Cohort *Centranthæ.*

Order Centrifloræ.

Cohort *Hydranthæ.*

Orders Fluviifloræ, Alismifloræ.

Cohort *Lirianthæ.*

Orders Glumifloræ, Spadicifloræ, Liliifloræ, Labellifloræ.

INFLUENCE OF SEVERE WINTERS ON VEGETATION.—The Botanical Society of France had its annual gathering at Fontainebleau this year, in the end of June. Among other matters that came up for study (we learn from *Revue des Deux Mondes)* was the modification of the flora of that district in recent times. A number of species have disappeared, chiefly by reason of severe winters. The winters of 1564, 1709, 1788 and 1879–80 were disastrous. Recent meteorology has proved that elevated places generally suffer less from cold than those of low position. The trees on low ground at Fontainebleau have suffered peculiarly. Cereals have suffered more on high ground, because snow is their best defence against frost, and on exposed points it is more driven about by wind. Many herbaceous plants, too, have been protected by snow, but several which grew on walls or the face of rocks have succumbed. Evergreens have suffered more than others, and the general destruction of the maritime pine in the central parts of France (in Champagne, Garthe, Rambouillet, as well as at Fontainebleau, it has perished), is a grave loss to the country. Among other plants which have been frozen out, or nearly so, in the center of France, are the broom heather, holly, ivy and box. Among species with caducous leaves, the elder, and even the oak, have seriously suffered; and the loss of chestnuts and walnuts, which used to be largely cultivated in the valley of the Loir and in Touraine, have thrown idle for a long time the oil-mills of that part of France. The Fontainebleau flora has been enriched, in recent times, with various new species, as well as impoverished by disappearance of old ones.—*English Mechanic.*

BOTANICAL NOTES.—Professor Goodale, of Harvard University, sails for Germany soon, to remain a year.——Dr. Gray intends to return from his sojourn in Europe early in the autumn.——The Cincinnati meeting of the American Association for the Advance-

ment of Science did not yield much in the way of botanical papers. A half dozen papers, some scarcely passable, constituted the whole contribution from the botanists of the Association. What are our botanists doing? Doubtless they are busy; but it is not creditable to American science that so few papers were presented by them, especially when we bear in mind the length of the list of American botanists. A movement is under way to make a better showing in botany at the Montreal meeting.——One of the best botanical papers presented at Cincinnati was by Dr. Beal on the "Movements of Roots in germinating Indian Corn." Darwin's statement that "in whatever direction the primary radicle first protrudes from the seed, geotropism guides it perpendicularly downwards," was shown to require modification. Over four hundred kernels of sprouted Indian corn were placed over a large pan of water and set in the dark. No gummed papers were placed on the radicle-tips of these, yet they took many different directions. In all the lots, one coil or more was a very common thing; some coiling over and some under. Many went downwards, some in nearly a horizontal position, several directly upward where two of them made three coils each. No roots were tested in soil. An abstract cannot do this paper justice, since it was much condensed as it was presented. The results were quite remarkable. At another time some seeds were sprouted over water in the dark. Small pieces of gum paper placed a trifle one side of the tip, usually caused the root to bend away to a marked degree, sometimes only a trifle, and sometimes it produced no effect.——Professor Penhallow's paper on the "Phenomena of Growth in Plants," dealt with the movements of the stem and tendrils of the Mammoth squash.——Professor Meehan contributed "Additional facts on the Fertilization of Yucca." By artificial self-fertilization of pistils of *Yucca angustifolia*, fruit was obtained, although the pollen was applied to the *external* lobes of the stigma.——The August number of the *American Monthly Microscopical Journal* contains half a dozen formulæ for preservative media for use in mounting microscopical preparations of vegetable tissues.——Rand, McNally & Co., of Chicago, have just issued "The American Encyclopædia of Agriculture," by Jonathan Periam. An examination of the botanical part of the work shows that unusual care has been taken in its preparation.

ZOÖLOGY.

Recent Zoological Work in France.—Among the most important zoölogical memoirs published in France, are those to be found in Lacaze-Duthier's Archives de Zoologie expérimentale et générale. The eighth volume, for 1879-'80, contains an elaborate essay, with most excellent plates, some of them printed on stone in colors, by L. C. Cosmorici, on the anatomy of the

polychete Annelids. This is followed by a similar paper on a leech *(Batracobdella latastii)*, by Dr. C. Viguier, which is succeeded by an abstract of Professor W. K. Brooks' essay on the development of Lingula, a compliment to American science. Then follows a valuable essay on the existence of the *saiga* in France in the Quaternary epoch, by Professor A. Gaudry. The reproduction of sponges by external budding is discussed by C. de Merejkowsky. This subject has heretofore been treated only in a fragmentary way. It is known to take place only in one family (Suberitidinæ, in the genera Suberites, Tetilla, Tethya and Rinalda). The buds are always produced under the form of an expansion at the extremity of a stem or peduncle which arises from the surface of the body of the sponge. The peduncle supporting the bud or enlargement, is always solid and composed of spicules and of the syncytium without canal and without pores; while the bud itself is produced by the syncytium alone and its spicules, without any participation by the entoderm; and its cavities, at first entirely wanting, are formed independently of the maternal cavity. In an abstract of the author's views as to the morphology of the sponges and hydroids, he believes that the hydroid as well as the sponge, is the product of the multiplication of this primitive individual, but while the hydroid is a polymorphous colony composed of completely distinct and separate individuals, regularly disposed in a determinate order, the sponge is formed of a colony of individuals irregularly dispersed, without any arrangement, and forming a single compact mass. In his researches on the histology and development of Campanularia, M. J. Fraipont makes a valuable contribution to the literature of the history of the origin of the genital glands in this hydroid.

The Monera of Central Russia are described by A. Korotnoff, who has rediscovered Haeckel's *Protamœba primordialis*, which he regards as occupying the lowest place in the class of Rhizopodes. Other Amœboid forms are described, as well as the development of Pelomyxa, to which a plate is devoted. Professor Patrick Geddes publishes in these archives his observations on the perivisceral fluid of the sea urchin and the corpuscles contained in this fluid. The viviparity of *Helix studieriana* engages the attention of Professor Viguier, while the last paper of the volume is by the editor, on *Laura geradiæ*, elsewhere noticed in this journal.

Evolution and Hybridism in Ornithology.—In a review in *Nature*, of the British Museum Catalogue of Birds, volume fifth, containing the family *Turdidæ*, by Henry Seebohm, it is stated that one great feature of the work is the courage which the author has shown in applying the doctrine of the evolution of species to the birds as they exist at the present day. The great risk that the reviewer sees in Mr. Seebohm's method lies in the fact that it affords too easy a solution for otherwise difficult

problems, but we must remember that the author was himself witness to the inter-breeding of the carrion crow and the hooded crow in Siberia, and it is known that this also takes place in certain parts of Great Britain. Having seen this with his own eyes, and brought back to England a large series of the hybrids, it was only reasonable for him to suppose that other birds are also capable of hybridizing, and the reviewer thinks that the author proves his case with regard to the two blue rock thrushes (*Monticola cyanus* and *M. solitarius*), which in certain parts of China interbreed; and it is most curious that the vast majority of the birds found in the winter quarters of the Eastern blue rock thrush, from Burmah and Malaisia to the Mollucca islands, appear to be hybrids. According to the author, *Cettia cantans* and *C. minuta* also interbreed, and produce an intermediate form which he calls *Cettia cantans minuta*, a reintroduction of trinomial nomenclature which the reviewer does not at all like. The intermediate form, too, appears to be principally found in the Island of Formosa, though also met with at Chefoo, on the mainland opposite Japan, while one of the other forms is an inhabitant of Japan, with the exception of one Formosan skin in the author's collection, and the other is said to breed in South China and Hainan. Of these three forms, then, we should suppose that the Formosan was the oldest bird from which the other two had developed themselves, but that they had not as yet become entirely separated as distinct species. We must wait for more evidence with regard to the South African chats, to some of which Mr. Seebohm has applied his principle of hybridization, as the reviewer is not yet satisfied that the changes of plumage cannot be accounted for by the more natural process due to age or the season of the year.

Breeding Habits of the Fish Hawk.—On the 28th of April I visited, in the southern part of Rhode Island, what could be called a colony of these birds, for from my position at a nest in the top of a buttonwood tree, I could count no less than twelve of their massive structures, all in a radius of half a mile. In one tree I saw what appeared to be two nests, but on closer examination found that a nest had fallen and lodged in the lower branches, the birds using the old site for a new home.

As one approaches their nest the bird stands up, whistling a shrill peep, on coming nearer it rises, and after a circle or two sometimes re-alights, inspects its eggs, and if the intruder does not withdraw, the cries of distress bring the male, after which both birds circle over the nest, the male higher and showing less anxiety than the female.

In one case, on ascending to the nest of an old pair, I was attacked by the birds and forced to descend; but I think it is seldom that they manifest so much courage. The bird at other times is extremely cowardly, allowing crows to chase it, and once I saw a crow blackbird, whether *Quiscalus versicolor* or *æneus*, I

do not know, that had its nest in the basement of a fish hawk's, attack and drive its host from home.

The nests of the fish hawks were by no means shabby. The sticks, of which they were composed, were short and crooked and so firmly held together by turf and eelgrass, that it was a difficult undertaking to obtain the eggs by tunneling from the bottom. The top is very shallow; in the nests that I examined it was not more than two inches deep, but averaging fifty-four inches in diameter. I noticed that the female sits during the day for a long period before the eggs are laid; more than two weeks in one case. During the night she leaves the nest and roosts on a neighboring limb, where she is very indifferent to all about her, even allowing a person to throw stones at her without flying off. If the nest be disturbed during the night, when there are young or eggs, the bird flies off only uttering a few cries, and does not return while its nest is being robbed.

I examined more than twenty trees in which nests were placed, and found them all alive, but in a few cases the limb on which the nest was placed, was dead.—*H. C. Bumpus.*

Blackbirds Catching Fish.—A mill-dam is in process of repair near my residence, on Boone river. Visiting the spot to-day, I was much amused to see some crow blackbirds catching minnows! At one end of the dam the water was forcing its way through in a small stream which ran with great rapidity, from the descent as well as from the pressure above. This little stream spread out over some loose boulders in a sort of fan-shape, being generally not more than one inch deep. Up this steep place myriads of minnows, two to three inches in length, were trying to force their way. Many of them were unable to stem the current and were swept down stream. In this swift, shallow water, three or four crow blackbirds (doubtless *Quiscalus æneus* Ridgway) were wading about, keen and alert, every moment or two picking up and swallowing a minnow. They appeared to understand their business to perfection, and made no mistakes—seeming to get one of the little fishes every time they made the attempt. I have often seen these birds wading in the shallow water along the margin of the stream, but this is the first instance in which I have seen them capture fish. They are very tame, making themselves entirely "at home" in our barnyards and fields. The groves along our little river are their favorite nesting-places. There used to be some complaint in regard to their raids upon cornfields just as the young blades were a couple of inches high, but I have heard nothing of the kind in recent years.—*Charles Aldrich, Webster City, Iowa, May 11, 1881.*

Habits of the Rocky mountain Axolotl.—Mr. W. E. Carlin, in an article in the Proceedings of the U. S. National Museum, on *Siredon lichenoides*, the larva of Amblystoma, observed by him

in Lake Como, Wyoming Territory, states that they never enter the stream of fresh water, preferring the alkali water of the lake. The change from alkali to fresh water undoubtedly hastens the metamorphosis into the Amblystoma form. "In two cases the change in external appearance was so abrupt that I would have been almost certain that another salamander had been substituted for the one in the jar, had I not had him so completely under observation that it was impossible. The gills had assumed a stubby form about half the length that they were the night before, and the gill on the back of the body was nearly half gone; it took air quite often, and I removed it from the jar and placed it in a box with some lake grass around it to keep it moist. It completed the metamorphosis in a few days. I did not feed it any during this time. While it was in the jar it was well fed with flies." Mr. Carlin found that the axolotl late in July and during August, leaves the lake in large numbers on rainy days and transform. "While catching Siredon, I have seen and caught a number of Amblystoma in the lake, with the metamorphosis, as far as I could see, as complete as those we find half a mile from the lake. They cover the ground by thousands during a warm summer rain, coming from every conceivable place where they could have found shelter, from under rocks, boards, old ties, and out of gopher holes. I have a cat that eats them greedily, and I am told by a resident that the numerous skunks that live around the lake live principally on them." After the first frost they completely disappear.

Systematic Position of Balanoglossus.—Elias Metschnikoff has returned to the view which he expressed twelve years ago with regard to the close affinity between this curious "worm" and the Echinoderms. The larvæ of the two types are identical, since the differences insisted on by A. Agassiz as regards the water-vascular system have been shown by Goette to be erroneous. Metschnikoff claims that the water-vascular system, which is so eminently characteristic of the Echinoderms, is represented in Balanoglossus by the proboscis-sac, which he regards as a single, conical, ambulacral tentacle, and it should be borne in mind that in Synapta, which is a genuine Holothurian, not only the ambulacral cœcal sacs, but also the longitudinal trunks are lost. The peritoneal system would also seem to be represented in Balanoglossus, and is lined by just the kind of membrane as in the Holothurians, while the circulatory system in these Echinoderms is very similar to that of Balanoglossus. He regards the gills as rudimentary water-vessels delayed in development and undergoing vegetative repetition. The absence of calcareous matter from the integument of the worm is a notable point of difference, but on the other hand the nervous system is very similar. The author therefore proposes to form the type *Ambulacraria*, with the two sub-types of *Radiata* and *Bilateralia*, the type of the latter group being Balanoglossus.

Unusual Actions of a Hen Turkey.—While visiting in the southern part of Indiana, this spring, my attention was called to the strange proceedings of a young hen turkey. She was on her first "setting" of eggs, and was doing her best apparently, but nothing came of it. For two months she kept her place steadily and at the end of that time an attempt was made to break up the nest. It was found there were but two eggs left of the seven she began with. It was a complete disappearance, not even a trace of the five missing eggs being left. The next day an egg was accidentally discovered in a woody pasture, a quarter of a mile from the nest, having been apparently dropped there. It was very light, being almost empty. On the following day, while half a dozen of the family were sitting under the trees within twenty yards of the nest, the turkey rose, flying high over the house and off towards the pasture, and in her mouth was an egg. A visit to the nest showed but one egg left. In a short time the hen came walking back and took her place on the nest. It was evident that six eggs had been carried off in this way at different times and dropped in different places. Whether this proceeding showed a feeling of disgust on the part of the turkey, or was merely an instinctive clearing of the nest, I cannot say.—*John M. Coulter.*

Change of Color in Crabs and Prawns.—Dr. Fritz Müller contributes some instances of this phenomenon—already discovered by Kröyer—from the Brazilian fauna. A shrimp *(Atycida potimirim)* has a female which, when adult and living among water-plants, is usually dark green, sometimes inclined to blue or brown, occasionally of a pure blue with a pale brown streak down the back; when put into a glass vessel it fades to an increasingly pale brown, which disappears and leaves the animal colorless and transparent in the course of a few days; a dark brown specimen placed with a number of others which had the usual greenish hue assumed their color in a few minutes. A black Palæmon taken from deep water became first dark, then pale blue, and the color, losing its even distribution, became accumulated in many closely-packed patches; after half a day from the time of capture it had lost all color, with the exception of the caudal swimmeret, which remained blue. The male of a small land crab (Gelasimus), whose carapace is marked with pure white and light green, loses these colors when captured, and they are replaced by a uniform gray.—*Journal of the Royal Microscopical Society.*

The Blue Gull.—During some of our wet seasons a little blue gull stays with us all through the summer. I believe they always come here in the spring, but if the water dries out of the ponds and sloughs, they do not remain—probably retiring to the lakes, where open water is always to be found in warm weather. They are quite tame, flying often very close to men and teams. They seldom alight upon the ground, and it is a popular notion that they are

never seen except on the wing. I have, however, occasionally seen them sitting upon the muskrat ponds out in the sloughs. They often follow a plowman, greedily devouring the worms and bugs which are turned up to the surface. Fluttering down very gracefully, they pick up their game without setting a foot upon the ground! In this manner they requently follow the plow for hours, so intent upon their work that they might easily be killed with a blow from the plowman's whip.—*Charles Aldrich, Webster City, Iowa, May 11, 1881.*

Male Crustacea producing Eggs.—In the course of his studies on the Amphipods of the Adriatic, Herr Neteski found that eggs are developed in the testes of the males. These organs are in the form of simple tubes, consisting of a germ-gland and an efferent portion. Only the hinder half of the tubes produce male products, the anterior quite constantly developing eggs, but for these there is no special duct. The egg-producing portion has much the same microscopic structure as that in which the spermatozoa are developed, and the rudimentary eggs are only distinguished from the spermatoblasts by developing into eggs. The eggs developed in the male differ from those of the female in the structure of their protoplasm, for the yolk-spheres are not in them so distinctly developed, and it would appear that they never become fully matured. This remarkable phenomenon has not, therefore, any physiological significance, and in structure the organ is truly a testis. The author reminds us that Phalangium stands in a similar condition.

Animal Pests in Greenwood Cemetery.—The New York *Sun*, citing the report of the trustees of Greenwood Cemetery for 1880, says: "It is noted that chipmunks made their appearance in the cemetery during the last year for the first time. The injury done by them has been deemed a sufficient cause for their extermination, and 2853 of them were killed. Ground mice to the number of 375, 148 cats, 40 dogs, 133 snakes, 24 moles and 54 rats have also been killed.

Zoölogical Notes.—A nervous system has been discovered by Dr. Chun in the *Velellidæ*, a family of Siphonophores; it consists of a quite typically differentiated plexus of branching and intercommunicating ganglion-cells.——The coloring matter of jelly fishes has been investigated by Professor McKendrick, who finds that it consists of little irregular particles scattered through the protoplasm. It was also examined with the spectroscope.——The sixth and seventh parts of Bütschli's Protozoa have appeared. This work forms a volume of Bronn's *Classen und Ordnungen des Thierreichs*. The author believes that Bessel's account of Bathybius is worthy of all confidence, while he inclines to the view that Eozoon is inorganic.——The sexual organs of the harvest men (Phalangidæ) have been critically examined by Dr. Blanc, who, after describing the testes and ovary, states that in young males

eggs often occur on the surface of the testes; so that here there is a rudimentary hermaphroditism, the structural arrangement, however, not permitting self-fertilization.——Whether the shells of Planorbis are dextral or sinistral, Mr. R. E. C. Stearns discusses in a very interesting and suggestive paper in the Proceedings of the Academy of Natural Sciences, of Philadelphia. He believes that they are sinistral. The variations in the shells of certain species are then described in a way to be of much value from an evolutionary standpoint.——The publication of the Bulletin of the Buffalo Society of Natural Sciences has been resumed by the issue of the first number of Volume IV, the most interesting article in which is Mr. E. E. Fish's on the imitative and ventriloquial power of birds, containing original observations of merit.——A third paper on American spiders, by Count Keyserling, appears in Verhandlungen der K. K. Zoöl.-bot. Gesellschaft in Wien. Among the new species are *Epeira cavatica* from caves in Kentucky, and *Cælotes juvenilis* from Mammoth cave.——We glean the following notes from the Proceedings of the U. S. National Museum, June–August: Capt. Bendire has shown that the supposed land-locked little red salmon *(Oncorhynchus kennerlyi)* of the Upper Columbia, is nothing but the young breeding male or grilse of *Oncorhynchus nerka*.——The genera and species of the family *Centrarchidæ* are reviewed by Mr. C. L. McKay. The detailed review of the genus Centurus will interest ornithologists, while there are several descriptive ichthyological papers by Bean, Jordan, Lockington, Rosa Smith and Gill.

ENTOMOLOGY.[1]

NOTES ON HYDROPHILUS TRIANGULARIS.—The article by Mr. Garman in the August number has provoked an inquiry as to the appearance of the water beetle there referred to. The accompanying illustration (Fig. 1, *b*) will, we believe, convey the desired information even better than could words.

Having, in 1876, reared *Hydrophilus triangularis* from the egg to the perfect state, and made a number of notes upon it, we would take this occasion to supplement Mr. Garman's article with a few facts that may interest the general reader. The asymmetry in the jaws, noted by Mr. Garman, is constant so far as we have observed, and is, in fact, quite common in Carabidæ generally. The egg-case of *H. triangularis*, described by Mr. Garman, differs materially from that of the European *H. piceus*, according to descriptions of this last. We found the former to consist virtually of three distinct parts, and the subsidiary figure (2) will, perhaps, more fully indicate these parts than did Mr. Garman's outlines. There is, *first*, what may be called the floater (Fig. 2, *c*), which

[1] This department is edited by PROF. C. V. RILEY, Washington, D. C., to whom communications, books for notice, etc., should be sent.

itself is composed of two parts, viz: (1) a hard spatulate piece of compact brown silk, smooth externally and with the two edges of the tapering end curled inside and welded at tip so as to form a

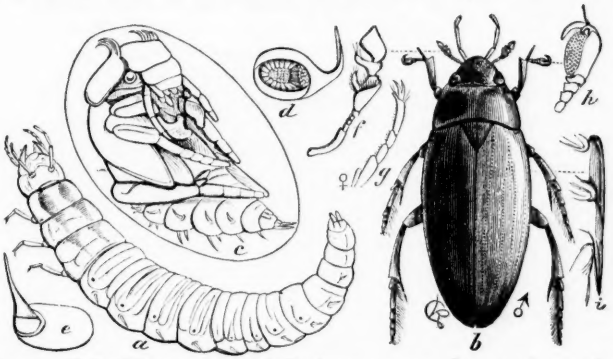


FIG. 1.—*Hydrophilus: a*, larva of *H. piceus*; *c*, pupa of same; *d*, opened egg-case showing arrangement of eggs; *e*, closed do; after Blanchard; *b*, ♂ of *H. triangularis; f*, antenna of same; *g*, front tarsus ♀; *h*, do of ♂; *i*, stout sternal spine, side view; after Riley.

stout point (Fig. 2, *g*), and (2) a somewhat cuneiform air-chamber (Fig. 2, *d*, *h*). There is, *second*, the egg-case proper (Fig. 2, *i*), and, *third*, the outer bag or covering (Fig. 2, *f*, *k*). The air-chamber has an external, slightly bulging covering (*d*) of the same character as the outer bag of which it forms a part, but of somewhat darker silk, while the inside *(h)* consists of loose brown silk forming large cells and connecting with the spine, the hollow parts of which are in fact filled more or less compactly with these

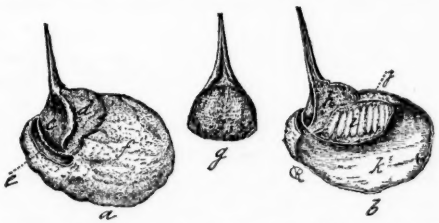


FIG. 2.—Egg-case of *Hydrophilus triangularis: a*, full side view; *c*, floater; *d*, air-chamber; *f*, outer bag; *e*, opening; *g*, floater detached, showing inner side; *b*, ideal sectional view of *a*, showing the three divisions of air chamber (*h*), egg-case proper (*i*) and outer bag (*k*)—after Riley.

silken fibers. The egg-case proper, which is of a white, rather flimsy or paper-like silk is partially suspended posteriorly from the roof of the outer bag by white loose silk, but is principally attached to the inferior side of the air-chamber, which so narrows toward the broad end of the spatulate piece that this last is vir-

tually attached to the anterior part of the egg-case, its attachment to the outer bag being so slight as to admit of the frontal rent (Fig. 2, *e*).

The young larvæ generally break through the back part of the egg-case proper and remain for a day or two, and until they have visibly increased in size, within the outer bag, issuing finally through the frontal rent through which the water is easily admitted. When floating freely the floater is always mostly out of water, the point upward and obliquing slightly forward. The eggs are thus bathed in water but freely aërated. The spike seems to be essential to their well-being, as Mr. A. G. Laker[1] found that those of *H. piceus* failed to hatch when it was cut off, yet the somewhat similar case of the common *Hydrobius fuscipes* has no such point, but in its place the silk is extended from beneath the leaf to which the case is attached to the upper surface over which it is spread, and according to Mr. Laker they will hatch if kept entirely under water.

We conclude that the curious contrivance in *Hydrophilus* is intended not only to secure an ample supply of air to the eggs and to protect them, but also to protect the newly hatched young from their numerous enemies until their jaws have strengthened and they are better able to begin the struggle for existence.

We have often been curious to know whether or not the sternal spine of the beetle was used to form the point of the floater. It seems useful for such a purpose and yet occurs in both sexes. If any of the readers of the NATURALIST have ever observed the formation of this curious egg-case, we shall be glad to have the process described.

The larva loses its hairiness after the first molt, and the mature larva differs from the young larva principally in the relatively shorter legs and mouth-parts. We were struck with the ravenousness and rapid growth of this larva, those hatching on the 26th of July having passed through the first molt on the 30th of the same month, and through a second molt on the 3d of August. The larva of *H. piceus* is said by European writers to pass through three molts, but we observed only two in our larvæ. They were full grown a week later, and by the 5th of September the first one had gone through its transformations, and issued as a beetle. The molt takes place in all sorts of situations, and even while the larva is floating on the surface of the water. The color becomes paler toward each molt but dark afterwards, the characteristic dark and sordid-white mottlings, especially the wavy lines along the back, being most conspicuous just after the molt. They fed on everything with which they came in contact, as young Ephemerid and Libellulid larvæ, other aquatic animals, and even raw beef which we gave them.

The pupa, which was readily formed in a large flower pot filled

[1] *The Entomologist* (London, Eng.), XIV. p. 83.

with earth kept well moistened, closely resembles that of *H. piceus* of Europe, so that the figure of that species here given (Fig. 1, *c*) will very well illustrate its appearance. The anal appendages are much longer in our species, very stout and parallel in their basal third, thence suddenly narrowed and slightly divergent. They are annulated and their length seems to vary according to the specimens. In the middle of the anal joint there is ventrally a triangular tubercle, and on the apical margin of the penultimate joint are two more prominent, connected, cone-like protuberances. The anal joint dorsally terminates in two stout, short tubercles, each bearing a spine. The pupa is chiefly characterized by the sternal process or spine, and by having on each abdominal joint behind each spiracle, a filamentous, curved, tapering process, minutely annulate and with a seta issuing from tip. On each side of the anterior border of the prothorax is a set of three of these processes largely developed. Their function has not been critically studied, but they undoubtedly act as secondary tracheæ.—*C. V. Riley.*

The Cultivation of Pyrethrum and Manufacture of the Powder.[1]—2. *Application of Pyrethrum in Fumes.*—The powder burns freely giving off considerable smoke and an odor which is not unpleasant. It will burn more slowly when made into cones by wetting and molding. In a closed room the fumes from a small quantity will soon kill or render inactive ordinary flies and mosquitoes, and will be found a most convenient protection against these last where no bars are available. A series of experiments made under our direction, indicates that the fumes affect all insects, but most quickly those of soft and delicate structure.

This method is impracticable on a large scale in the field, but will be found very effective against insects infesting furs, feathers, herbaria, books, etc. Such can easily be got rid of by enclosing the infested objects in a tight box or case and then fumigating them. This method will also prove useful in greenhouses, and, with suitable instruments we see no reason why it should not be applied to underground pests that attack the roots of plants.

3. *Alcoholic Extract of Pyrethrum powder.*—The extract is easily obtained by taking a flask fitted with a cork and a long and vertical glass tube. Into this flask the alcohol and Pyrethrum are introduced and heated over a steam tank or other apparatus. The destillate, condensing in the vertical tube, runs back, and, at the end of an hour or two the alcohol may be drained off and the extract is ready for use. Another method of obtaining the extract is by repercolation after the manner prescribed in the American Pharmacopœia. The former method seems to more thoroughly extract the oil than the latter; at least we found that the residuum of a quantity of Pyrethrum from which the extract was obtained by repercolation had not lost a great deal of its power. The first

[1] Concluded from September number.

method is apparently more expensive than the other, but the extract is in either case more expensive than the other preparations, though very conveniently preserved and handled.

The extract may be greatly diluted with water and then applied by means of any atomizer. Professor E. A. Smith of Tuscaloosa, Ala., found that, diluted with water, at the rate of one part of the extract to 15 of water, and sprayed on the leaves, it kills cotton worms that have come in contact with the solution in a few minutes. The mixture in the proportion of one part of the extract to 20 parts of water was equally efficacious, and even at the rate of 1 to 40 it killed two-thirds of the worms upon which it was sprayed in 15 or 20 minutes, and the remainder were subsequently disabled. In still weaker solution or at the rate of 1 to 50 it loses in efficacy, but still kills some of the worms and disables others. Professor Smith experimented with the extract obtained by distillation, and another series of experiments with the same method was carried on last year by Professor R. W. Jones of Oxford, Miss.[1] He diluted his extract with twenty times its volume of water and applied it by means of an atomizer on the cotton worm and the boll worm with perfect success. Mr. E. A. Schwarz tried, last summer, the extract obtained by repercolation[2] and found that 10 drachms of the extract, stirred up in two gallons of water and applied by means of Whitman's fountain pump was sufficient to kill all cotton worms on the plants. Four drachms of the extract to the same amount of water was sufficient to kill the very young worms.

4. *Pyrethrum in simple water solution.*—So far as our experiments go, this method is by far the simplest, most economical and efficient. The bulk of the powder is most easily dissolved in water, to which it at once imparts the insecticide power. No constant stirring is necessary and the liquid is to be applied in the same manner as the diluted extract. The finer the spray in which the fluid is applied the more economical is its use and the greater the chance of reaching every insect on the plant. Experiments with Pyrethrum in this form show that 200 grains of the powder stirred up in two gallons of water is amply sufficient to kill the cotton worms, except a very few full-grown ones, but that the same mixture is not sufficiently strong for many other insects as the boll worm, the larva of the *Terias nicippe* and such species as are protected by dense, long hairs. Young cotton worms can be killed by 25 grains of the powder stirred up in two quarts of water.

The Pyrethrum water is most efficacious when first made and loses power the longer it is kept. The powder gives the water a light greenish color which, after several hours, changes to a

[1] Vide *American Entomologist*, Vol. III, pp. 252–3.

[2] From one pound of the powder one pint of extract was made, each drop of the extract representing one grain of the powder. The actual cost of making the extract was 50 cents.

light brown. On the third day a luxuriant growth of fungus generally develops in the vessel containing the liquid, and its efficacy is then considerably lessened.

5. *The Tea or Decoction.*—Professor E. W. Hilgard of Berkeley, Cal., is the only one who has experimented with Pyrethrum in this form and expresses himself most favorably as to the result. He says:

"I think, from my experiments, that the *tea or infusion, prepared from the flowers* (which need not be ground up for the purpose) is the most convenient and efficacious form of using this insecticide in the open air; provided that it is *used at times when the water will not evaporate too rapidly*, and that it is applied, not by pouring over in a stream, or even in drops, but *in the form of a spray from a syringe* with *fine* holes in its rose. In this case, the fluid will reach the insect despite of its water-shedding surfaces, hairs, etc., and stay long enough to kill. Thus applied, I have found it to be efficient even against the armored scale-bug of the orange and lemon, which falls off in the course of two or three days after the application, while the young brood is almost instantly destroyed. As the flower tea, unlike whale soap and other washes, leaves the leaves perfectly clean, and does not injure even the most tender growth, it is preferable on that score alone; and in the future it can hardly fail also to be the cheaper of the two. This is the more likely, as the tea made of the leaves and stems has similar, although considerably weaker, effects; and if the farmer or fruit grower were to grow the plants, he would save all the expense of harvesting and grinding the flower-heads, by simply using the header, curing the upper stems, leaves, and flower-heads all together, as he would hops, making the tea of this material by the hogshead, and distributing it from a cart through a syringe. It should be diligently kept in mind, that the least amount of *boiling* will seriously injure the strength of this tea, which should be *made* with briskly boiling water, but then simply covered over closely, so as to allow of as little evaporation as possible. The details of its most economical and effectual use on the large scale remains, of course, to be worked out by practice."

The method of applying Pyrethrum in either of the three last-mentioned forms is evidently far more economical in the open field and on a large scale than the application of the dry powder, and, moreover, gives us more chance of reaching every insect living upon the plant to which the fluid is applied. The relative merits of the three methods can be established only by future experience.

Migration of Plant Lice from one Plant to another.—M. J. Lichtenstein of Montpellier, France, whose important entomological writings are known here as well as in his own country, has been appointed by his Government to especially study all questions relating to the habits of the Aphididæ. M. Lichtenstein has for some years fully believed that most of our Aphids, and especially the gall-making *Pemphigini*, habitually migrate, in the winged, parthenogenic, female form, from one plant to another, and that the species must necessarily inhabit two different plants before it passes through its full cycle of development. That it is the rule for most of the insects of this family to so migrate is evident from the fact, patent to all who have observed them, that there is a period in mid-summer when most of the species abandon the plants which they so seriously affect in spring and early summer. This disappearance, emphasized already in 1829, by Joshua Major, in

treating of the apple tree plant louse,[1] has usually been attribued to natural enemies of the Aphids, but these play only a part in causing it. The fact of migration rests, moreover, on repeated direct observations, and all spring gall-inhabiting species have usually vacated their galls by mid-summer. The air has often been seen to swarm with Aphids, and Reaumur observes that in migrating they sometimes actually darken the air. In fact it is now coming to be well understood, that in this family the habit of the same species in spring is quite different to its habit in the fall, and that in the study of the insects of this family there is opened up to us a new and interesting field for observation comparable to that of late years developed by the discovery of dimorphism in the *Cynipidæ*. We have for some time since recognized this fact of migration, but have been led to believe from the known facts in the case that the migration was necessarily from one plant to another of the same *genus*. M. Lichtenstein, on the contrary, believes that the change is still more wonderful and that many tree-inhabiting and gall-making species actually have a mid-summer life on the roots of grasses and herbaceous plants. He has recently communicated to us some discoveries that certainly justify his views. In the genuine *Aphidini* he has ascertained that *Aphis (Phorodon) humuli* migrates from *Prunus* to *Humulus*, and that *Aphis (Myzus) asclepiadis* Passerini *(nerii* Boyé*)* migrates from *Asclepias* to *Nerium*.

The Chinch Bug.—The connection of meteorological conditions, especially the amount of rain-fall, with the increase or decrease of this notorious pest has long been recognized by entomological writers. From a *résumé* of the chronological history of bad chinch bug years and the effect which temperature may have on the insect, Professor Cyrus Thomas showed a year ago *(American Entomologist*, Oct., 1880) that the insect would probably be bad in 1881. How disastrous it really has been in the Western States, especially in Kansas, may be gathered from the fact that a chinch bug convention, the first ever held in the U. S., was held recently at Windsor, Kansas. A large number of farmers participated in the discussion, and a resolution to exclude wheat from the growing crops was unanimously adopted—the length of time not being mentioned. It is understood, however, that the planting will be resumed at the earliest possible practicable period. Anticipating that this would be a bad chinch bug year, Professor Thomas recommended the sowing of a larger area of oats, and had this advice been more generally adopted it would have been of great benefit to the farmers of that region. The insect has been quite common in all parts of the country the present year. It attacked and injured, during the month of August, the rice fields in the vicinity of Savannah, Ga., and was noticed in July in great

[1] Treatise on Insects most prevalent on Fruit Trees and Garden Produce. London, England, 1829.

numbers on "sand-oats" and other grasses growing on the dunes at Fortress Monroe, Va.

PHYLLOXERA LAWS.—The existing laws regulating the traffic in plants with a view of preventing the introduction of the Grape Phylloxera, are thus summarized in the annual report of the Syndical Chamber of Nurserymen at Ghent.

"Introduction of living plants is wholly forbidden in Italy, Spain, Turkey, Roumania, Algeria, Cape of Good Hope.

"Introduction of living plants is permitted as usual, except in the case of vines, which are prohibited—Germany.

"Introduction of living plants packed as usual, is permitted, but with a certificate of origin, in Switzerland; and a similar certificate attested by a consul in Austria-Hungary.

"Introduction under ordinary conditions if provided with a consular certificate, *viséed*, is allowed in Portugal and its colonies."

ONE HALF THE VINE AREA OF FRANCE AFFECTED BY PHYLLOXERA.—The British Consul at Bordeaux, in a recent report, states that of the 2,200,000 hectares [one hectare = 2½ acres nearly] of vineyards in France, about 500,000, or nearly one-fourth are destroyed by the grape Phylloxera, while as many more are attacked. He states that the only sure remedy is submersion, which is resorted to with invariable success wherever possible. The only available preventive is by the use of our resisting American stocks.

LONDON PURPLE AND PARIS GREEN.—Professor C. E. Thorne, of the Ohio State University, has found by experience, during the past two years, that weight for weight London purple is more efficacious than Paris green as an insecticide. There is really no need of using it weight for weight, as one half a pound of the purple goes as far as one pound of the green and costs very much less. Though from the cheapness of the former there is less temptation to adulterate it than with the latter, yet there are still cheaper powders with which it may be and has been adulterated. If not carefully ground it is less effectual and apt to form lumps in mixing with water. Hemingway & Co., of New York, the originators of this insecticide, are taking particular pains to grind finely, experience having taught that increased care is warranted in the increased satisfaction which their article gives. Another purple poison is now being advertised as Paris purple. The base is a purple refuse obtained by A. Pourrier, of Paris, extensively used for coloring sugar paper, for the very reason that there is no arsenic or other poison in it. But as it costs but $1.75 per ton in Paris, enterprising parties are using it in imitation of London purple by adding the arsenic to it.

ENTOMOLOGIST FOR THE PACIFIC COAST.—At the recent well-attended meeting of the California Viticultural Commission, the desirability of having a state entomologist was discussed, and a

report submitted of the efforts hitherto made to create a chair of entomology in the State university. The people of the Pacific coast are evidently alive to the importance of studying their insect enemies, and we may expect soon to see some definite action taken by the State government.

DILAR IN NORTH AMERICA.—Mr. R. McLachlan describes in the August number of the *Entomologist's Monthly Magazine* (p. 55), under the name of *Dilar americanus*, the first species of this very singular (Neuropterous) genus known from North America. The typical specimen (a female) was collected by Mr. F. G. Sanborn at Bee Spring, Ky., in June, 1874.

LOCUSTS IN NEVADA.—The *Reno* (Nevada) *Journal* reports that the countless locusts that hatched in Western Nevada this spring did not do any damage, but emigrated in great swarms after having acquired wings, towards the Sierra Nevada, failing, it seems, to cross the mountains.

ODOR IN BUTTERFLIES.—Dr. Fritz Müller read a paper before the London Entomological Society, June 5, 1878, on the peculiar odor emitted by the males of some Brazilian butterflies. Miss Mary E. Murtfeldt calls attention, in the April number of *Psyche*, to the fact that some years before the publication of Dr. Müller's paper she observed, while spreading fresh male specimens of *Callidryas eubule*, a delicate, violet-like odor emitted from the specimens, and which was retained, to some extent, for several days; the females being not at all fragrant.

ENTOMOLOGY AT THE RECENT MEETING OF THE A. A. A. S.—Our report of the meeting of the permanent sub-section of Entomology of the A. A. A. S. is crowded out of this number.

ANTHROPOLOGY.[1]

THE INDIANS OF BERKS COUNTY, PA.—In our bibliographical list will be found the complete title of a work upon the Indians of Berks county, Pennsylvania, by Mr. D. B. Brunner. The volume consists of 110 pages of printed matter and 34 plates, containing 176 figures of stone implements and pottery. The people who held this territory when it was visited by the whites were the Delawares, or *Lenni Lénape* (original people), divided into three sub-tribes: the *Unamis*, or Turtles, the *Unalachtgos*, or Turkeys, and the *Minsis*, or Wolves. The Wolf tribe extended over the south-eastern part of Pennsylvania, including Berks county. The greater part of the matter in the volume is of the highest local interest, but there are several sections invaluable to the anthropologist. We notice on page 65 a very sensible and sufficient reason assigned for the Indian massacres and the expulsion of the Delawares from Berks county. Some allusions to aboriginal writing will be found at page 68, to cemeteries on page 73, to collections

[1] Edited by Prof. OTIS T. MASON, 1305 Q Street, N. W., Washington, D. C.

of relics, page 76, followed by quite an elaborate description of the principal types.

It needs only a little observation to remark what kinds of books and information students of our day are most eager to procure relative to the centuries that are gone. It is doing no violence to the rules of logic to infer that the men of the coming centuries will laugh at our vain speculations and pay enormous prices for old books which contain solid, local information. We never read a work of this character without wishing to take the author by the hand. The greatest scrupulosity should be exercised in compiling such records, for in most cases they become the court of last appeal.

THE ANTHROPOLOGICAL INSTITUTE OF GREAT BRITAIN.—Volume X, No. III, issued in Feb., 1881, is at hand. The contents are as follows:

Brabrook, E. W.—Memoir of the late Paul Broca, honorary member, with a portrait, pp. 242–260.

Codrington, Rev. Robert Henry—Religious beliefs and practices in Melanesia, pp. 261–314.

Lubbock, Sir John—Notes on a stone implement of Palæolithic type found in Algeria, pp. 316–319.

Price, F. G. Hilton—Camps on the Malvern hills, pp. 319–330.

Fison, Rev. Lorimer—Land Tenure in Fiji, pp. 332–351.

Gooch, William D.—Notes on the occurrence of stone implements in South Russia, pp. 352–357.

One is not astonished to find stone implements anywhere in our day, and these belonging to the various classes set up by specialists. Sir John Lubbock lays before us a specimen of palæolithic type from Algeria. In the same paper he denies objects of this class to Russia. The edge is quite taken from this assertion, however, by the paper of Mr. Gooch, in the same number, wherein appears the drawing of one very rude implement from that quarter.

Of more general interest are the papers of Messrs. Codrington and Fison.

To begin with the former, the observations of beliefs were confined principally to the Banks, New Hebrides, and Solomon groups. The beliefs of the Banks group are first worked up with care and those of the other two are then compared with these. Some very just observations are made upon the two difficulties in the path of the observer of religious phenomena among lower races, viz: the difficulty of sympathizing with the people and the want of a vocabulary.

The author also endeavors to trace the evidences of mixture in blood between the Negritos and pure Polynesians by the changes wrought in their beliefs. This is dangerous ground. The truth is, regulative ideas give place before a different civilization slowly, and so far as yet known capriciously. Again, we are constantly met with the dictum that like causes produce like effects in culture.

The Melanesians believe in ghosts, *Tamate*, and spirits, *Vui*, the

former are the disembodied spirits of men, the latter including beings corporeal and incorporeal, but never human. The reader will be highly interested in the slight step which this theology has made above fetichism, as, for instance, on page 275, "These *Vuis* are very generally associated with stones. It is not that the stone is a *Vui*, or that the *Vui* is in the stone, but that there is a connection between the *Vui* and the stone, that the stone is the spirit's outward part or organ. To a certain extent the same connection exists between *Vuis* and snakes, owls and sharks."

Mr. Lorimer Fison's paper touches most interestingly upon one of our own difficulties. Time and again we have been told, after paying a round sum to extinguish some Indian title: Those men had no right to make that treaty; according to the usage of our tribe the Council were the proper parties. So in Fiji, "an investigator who will listen to that only which the chiefs have to say about it, may easily come to the settled conviction that they, and they alone, are the owners of the land, and indeed of everything else; while another who takes the statement of the commoners only, may easily satisfy himself beyond all doubt that it is they who are the real proprietors of the soil. Both of these inquiries would be right to a certain extent, and both of them would also be wrong. The statement of the commoners I believe to represent the ancient custom. That of the chiefs sets forth the extent to which they have been able to override the custom."

HARVARD UNIVERSITY BULLETIN.—One must have many eyes to keep the run of anthropology. Mr. Justin Winsor, the librarian of Harvard University, is issuing monthly bulletins of the University in continuation of the Library Bulletin. The accessions to the Peabody Museum library appear in the lists. On page 216, June number (No. 19; or Vol. II, No. 6) will be found an account of explorations at Madisonville, Ohio, by Professor F. W. Putnam.

THE ARCHÆOLOGICAL INSTITUTE OF AMERICA.—The first of the American series of papers to be issued by the Archæological Institute of America, is a neat volume in sober brown octavo, containing 133 pages and eleven plates. It is the report of Mr. A. F. Bandelier upon his researches among the Pueblos, and consists of two distinct portions: 1. Historical introduction to studies among the sedentary Indians of New Mexico; and 2. Report on the ruins of the Pueblo of Pecos. As our praise will be much longer than our censure, it were better to administer the latter first. Well, here is a handsome book with neither table of contents nor index to guide the eager seeker after truth. This, however, is a venial offence compared with the reckless manner in which the excellent plates are scattered about the volume. As we conscientiously hunted them all out, a list with their localities is appended: Plate XI, front; VI, page 41; VII, page 42; I, page

45; IX, page 47; II, page 52; III, page 58; IV, page 67; X, page 70; V, page 78; VIII, page 81.

Both chapters are among the very best of Mr. Bandelier's writings, the latter especially meriting our unqualified praise. It shows what an enthusiastic man can do who adds to a profound knowledge of what has been accomplished, a clear apprehension of what remains to be done. The present volume is also free from that overburdening of foot-notes, which renders Mr. Bandelier's former treatises difficult to read, and lays him open to the charge of pedantry.

In the Historical Introduction the author not only utilizes the very latest authorities, but has enjoyed rare opportunities of examining unpublished manuscripts through the courtesy of his friends in Mexico and New Mexico.

The description of the Pecos ruins occupies the greater part of the book. About thirty miles south-east of Santa Fé, the valley of the Rio Pecos widens into a triangular space, in the center of which rises a table land on whose southern end are located the old church of Pecos and directly north the ruins of the ancient Pueblos. The church was erected about 250 years ago by the Indians, under the direction of the Catholic fathers. It is now a total ruin, even the roof having been used for building outhouses. There were two grand edifices upon the mesilla besides numerous smaller ones. From the walls now standing, Mr. Bandelier was able to secure enough measurements to recover the ground plans of the two ancient Pueblos, one of which was an oblong building, the other a hollow square partly open on the south; the area was enclosed by a wall of circumvallation. It will be impossible to do more than to allude to the excessive care exercised in securing the measurements of the hundreds of rooms in detail.

Three periods of occupation were brought to light in the investigations; a pretraditional epoch, marked by corrugated pottery; a traditional epoch, and a documentary epoch.

The pretraditional epoch rests upon the discovery of walls and graves built above a layer of ashes, charcoals, corncobs and corrugated pottery. The traditional period, which is also partly documentary, commences at an epoch unknown, but marked by glazed pottery and pueblo structures, and extends to 1598. The documentary period covers the remaining time up to the present day, although we are indebted to modern vandalism for the loss of precious material. The explosion of the Montezuma myth, p. III, is done in Mr. Bandelier's best manner.

ANTHROPOLOGY IN NEW ZEALAND.—There is no foreign journal of scientific work more prompt in its appearance than the Transactions and Proceedings of the New Zealand Institute, the thirteenth volume of which, issued April, 1881, is now before us.

The papers will be noticed under the title of their authors for the convenience of the bibliography:

Colenso, W.—On the Vegetable Food of the ancient New Zealanders before Cook's visit, pp. 3–38.

———Historical Incidents and Traditions of the olden times translated from old Maori writings and recitals, 38–57.

———Contributions to a better knowledge of the Maori race, pp. 57–84.

Kirk, T. W.—Description of Maori comb and arrow-heads, 436.

Hocken, Dr.—Lectures on the early history of New Zealand, 452.

ZUNI AND THE ZUNIANS.—A very handsome quarto pamphlet of thirty pages, with the foregoing title, bearing the name of Mrs. Tilly E. Stevenson, has come into our hands. Although there is no title page, one is not long in ascertaining that Mrs. S. is the accomplished wife of Col. James Stevenson, the explorer, of Major Powell's Bureau. The lady accompanied her husband to the Pueblo country in 1879, and gives us, in the work before us, the benefit of her own observations, some of which are entirely new. The modern pueblos are very plausibly connected with the ancient cliff-houses. The collection of snow in large reservoirs to supply water in the drought of summer, links on very happily with some of Mr. Bandelier's explorations. The pueblo and people of Zuñi are very graphically described, including their house life and cookery. An important intimation is to the effect that the wealthy portion live in the lower stories, those of moderate means next above, while the poorer families have to be content with the upper stories. The grinding of meal and the baking of bread are better described than we remember to have read elsewhere.

The most important part of the pamphlet and that which is of lasting value, is the description of pottery making. We did not know before that lignite is used as a degraissant, that some ware is made of strings of clay, while other varieties are built up by means of ribbon-like strips, that a surface wash is made by rubbing down sticks of dried white clay on a fine stone, that brushes made from the Spanish bayonet are used in the decoration, that the baking is done with sheep and goats' dung; and finally, that the beautiful black gloss is imparted to some vessels by rubbing them down with the utmost care before baking, and by suffocating them with a fresh supply of dried dung just as they are done baking, in order to compel them to suck in the smoke as they cool. Really this last mentioned fact, to use a familiar phrase, is worth the price of the book. A feast of good things must be in store in the voluminous report which Col. Stevenson is preparing in reference to his collections.

THE INDIANS OF CANADA.—Professor J. Campbell, of Montreal, read a paper before the Literary and Historical Society of Quebec, December 17, 1880, which has since been published in pamphlet form. The object of the lecture was no less a task

than tracing the origin of the Indians of Canada. Of the eleven families within the area of the Dominion—Algonkin, Wyandot-Iroquois, Dakota, Tinné, Thlinkit, Innuit, Haida, Chimsyan, Hailtzukh, Nutka and Selish—the four families of British Columbia and the Algonkin are held to be of insular origin, or Malayo-Polynesian. The Iroquois, Dakota and Tinné are, on the contrary, derived from Tungusic and Koriak-Japanese stocks respectively.

Professor Campbell, relying upon linguistic evidence mainly, and believing that no classification of peoples can proceed on the basis of such an accident as polysynthetism, erects a new criterium in the using or not using of prepositions, as follows:

Postpositional languages place the mark of relation after the noun, the temporal index after the verbal root, the active verb after its regimen, the nominative after its genitive, the noun after its adjective.

Prepositional languages place the mark of relation before the noun, the temporal index before the verbal root, the active verb before its regimen, the nominative before its genitive, the noun before its adjective.

Nine comparative vocabularies between Indian, Polynesian and Asiatic languages close the volume.

To be candid, it has never occurred to us that there is much in the method of inquiry pursued in this pamphlet; but it is due to the author to say, that what good it possesses cannot fail to be extracted by the immense amount of time and patience which Professor Campbell is expending upon it.

BIBLIOGRAPHY:

ALBY, CHR.—Der Bronchialbaum der Saügethiere und des Menschen nebst Bemerkungen über den Bronchialbaum der Vögel und Reptilien. Leipzig, 1880, W. Engelmann. Roy. 8vo, pp. 98, 10 pl.

ASTON, W. G.—Proposed arrangement of the Korean alphabet. *Tr. As. Soc.*, Japan, VIII, 1.

BASSETT, F. S.—Superstitions and Legends of the Sea. *United Service Mag.*, May, June.

BENEDIKT, M.—Das Mathematische Constructions und Orientirungsgesetz des Schädels der Primaten und Saügethiere. *Centralbl. f. d. Med. Wissensch.*, Berlin, 1881, XIX.

BORDIER, A.—Aptitude spécial des races blondes de l'Europe pour la suette. *J. de therap.*, Paris, 1881, VIII, 169–172.

BRUNNER, D. B.—The Indians of Berks county, Pa.; being a summary of all the tangible records of the Aborigines of Berks county, and containing cuts and descriptions of the varieties of relics found within the county. Written for the Society of Natural Sciences. Reading, Pa., by etc., Superintendent of the Schools of the city of Reading. Reading, Pa. The "Spirit of Berks" Book and Job Printing Office, 1881.

BUCCOLA, G.—La psicologia fiseologia in Italia, rassegna. *Rev. sper. di freniat.* Reggio-Emilia, 1880, VI, 197, 309.

Cambodia, The Architecture of. *Builder*, June.

CHASSAGNE, A., et E. DALLY—Influence précise de la gymnastique sur le developpement de la portrine, des muscles et de la force de l'homme, étude fondée sur 16, 330 observations, pesées, mensurations, essais dynamométriques faits a l'école militaire de gymnastique de Joinville-le-Pont. Paris, 1881.

DUVAL, M.—La doctrine du transformisme considérée dans les rapports avec l'anthropologie et embryologie. *Presse Med.*, Paris, 1880–1, I, 52, 66.

DWIGHT, T.—The sternum as an index of sex and age. *J. Anat. and Physiol.*, London, 1880–1, XV, 327–330.

EDKINS, J.—On the Japanese letters "Chi" and "Tsu." *Tr. As. Soc. Japan*, VIII. I.

FARR (*et al.*)—Report of the Anthropometric Committee. *Rep. Brit. Assoc.*, London, 1880, XV, 120–159.

FISKE, J.—What is Mythology? *Atlantic Month.*, July.

FRIDOLIN, J.—Studien über das Wachsthum der Extermitäten beim Menschen nach der Geburt. *Arch. f. Anat., &c.* Leipzig, 1881, 79–88.

GILL, THEODORE—Modern Anthropology. [A review of Tylor's "Anthropology" and Powell's "Abstract from Proc. of Anthrop. of Washington."] *The Critic*, N. Y., July 16, 1881.

HERIZ, ENRIQUE—Clasificacion de los conocimentos humanos. Barcelona, 1880. 8vo, pp. 8, 1 tab.

HOWARD, H.—Man's two Natures; man created by evolution; thinking, how produced; neurology. *Canada Med. Record*, Montreal, 1880–1, IX, 97–107.

LEBLOIS, P.—Etude sur la volonté et le libre arbitre; suivie de dissertations biologiques. Angers, 1881, 18mo.

MANOUVRIER, L.—L'anthropologie de l'Algérie. *Rev. Scient.*, Paris, 1881, 3s, I, 468–474.

MANTEGAZZA, P., and S. SOMMIER.—Studii anthropologici sui Lapponi. Milano, 1880, 4to, L. 120.

MILNE, J.—Stone implements from Otaru and Hakodate. *Tr. As. Soc. Japan*, VIII, I.

MORRIS, C.—Man and the vertebrate series. *Pop. Sc. Month.*, N. Y., 1880–1, XVIII, 783–797.

PIERCE, M. P.—The Indian Problem. *Stoddart's Rev.*, June.

Pleistocene Man, and his relation to the theory of development. The Lake Dwellers. *Cosmos*, May.

PREYER, W.—Psychogenesis; the development of the human mind in the first years of life. [From the German.] *Am. J. Obst.*, N. Y., 1881, XIV, 461–484.

RECLUS, E.—The Zulu Kafirs. *International Rev.*, June.

SATOW, E.—Ancient Sepulchral mounds in Kandzuke. *Trans. As. Soc. of Japan*, VIII, iii.

SCHURZ, C.—Present aspect of the Indian Problem. *No. Am. Rev.*, July.

SMIT, J. A. ROORDA—Contributions to the knowledge of the Hottentot race. [From the Dutch.] *Brain*, London, 1881–2, IV, 147–159.

TYLOR, E. B.—The races of mankind. Ill. *Pop. Sc. Month*, July.

WYATT-EDGELL, E.—Some remarks on hereditary influence. *Rep. Cong. San. Inst., Gr. Brit.*, 1879, London, 1880, I, 105–109.

WYMA—The mental development of the infant of to-day. *J. Psych. Med.*, London, 1881, n. s. VII, 62–69.

VOL. VII. TRANSACTION KANSAS ACAD. OF SC., TOPEKA, 1881—
Savage, Joseph—Mounds of Southern Kansas.
Adams, Hon. F. G.—Phonetic Representations of Indian languages.
Thompson, Dr. A. H.—On a recent Indian find near Topeka, Ks.
Mudge, B. F.—Mound-builders in Davis and Riley counties.

GEOLOGY AND PALÆONTOLOGY.

MAMMALIA OF THE LOWEST EOCENE.—Attention has already been directed, in these pages,[1] to the fauna of an early Tertiary period, probably the Puerco formation, which lies below the Wasatch, in New Mexico. I have recorded the presence of the Creodont genera *Periptychus*, *Triisodon* and *Deltatherium*, and probably the Saurian *Champsosaurus*. I now add the genera *Hyracotherium*, *Meniscotherium* and *Mesonyx*, and a number of new forms of considerable interest. These are a new genus allied to *Esthonyx*, and a series of genera and species with a suilline type of dentition, but whose affinities are by no means certain. This point cannot be determined until the characters of the feet are known.

Conoryctes comma, gen. et sp. nov. *Char. gen.*—Allied to *Esthonyx*. Inferior canines not rodent-like, with conic crowns. Molars 3–3, the first one-rooted, the second two-rooted, the third with an anterior conic cusp and a posterior grinding heel. True molars consisting of two lobes, of subcylindric section, separated by deep vertical grooves. Enamel developed on internal and external faces of crowns. *Char. specif.*—Founded on a mandibular ramus which lacks the last molar, and has the crowns of the others worn. The external faces of the molars are much more exposed than the internal, and are somewhat contracted inwards. In the unworn crown there is a distinct anterior inner cusp, which is soon confounded on attrition. The heel of the last premolar has a crescentic section, the internal horn the narrower. The anterior lobe is a robust cone. The base of the second (third) premolar is oblique to the axis of the ramus outwards and forwards. It is possible that there is a minute first premolar filling the short space between the second and the canine. No cingula; enamel obscurely plicate; ramus robust. Length of molars minus the last, .0465; length of base of first true molar, .010; width of do., .009; elevation of crown do., .0055; length of base of fourth premolar, .011; width of do., .008; elevation of crown of do., .0065. Anteroposterior diameter of base of crown of canine, .010. Depth of ramus at first true molar, .023; width of do. at do., .013. This genus differs from *Esthonyx* in the form of the fourth premolar. In the latter the anterior lobe is compressed and trenchant. The species is longer than any of that genus, and nearly equal to the *Ectoganus gliriformis*.

Catathlæus rhabdodon, gen. et sp. nov. *Char gen.*—With this genus I commence descriptions of some genera with bunodont dentition, which has some resemblance to that of some of the hogs. The one above named, with *Mioclænus*, remind one of

[1] April and August, 1881.

Tetraconodon Falc. and Lydd., in the enlarged proportions of their premolar teeth. I compare the genera as follows:

I. Third and fourth superior premolars one or two-lobed externally, and with internal lobes.

a. Superior premolars with two external lobes; inferior fourth with two median cusps.

Premolars not enlarged.....*Phenacodus.*

aa. Superior premolars with one external cusp, enlarged.

Inferior fourth premolar with internal crest and cusp.....*Catathlæus.*

Inferior fourth premolar without internal crest or cusp.....*Mioclænus.*

II. Superior premolars 1, 2 and 3 without inner lobe; third with three external lobes (Pictet).

Premolars compressed.....*Dichobune.*

In the genus *Catathlæus* the development of the premolars is remarkable, while the true molars are relatively small. The last three superior premolars have an elevated internal crescentic cingulum, homologous with the inner lobe of the fourth superior premolar of the ruminants. The general character of the true molars is that of *Phenacodus*. Parts of two or three individuals of this species have come into my possession, one of which includes nearly all of the molar dentition of both jaws. The external cusp of the superior premolars is compressed conic, and the internal cingulum extends to its *anterior* base in the second, third, and fourth. The crown of the last true molar is about as long as wide, while that of the first is wider than long. Each supports seven cusps; two subconic external; one large median internal, which is connected by ridges with a small anterior and posterior median. Then there are a small anterior and posterior internal, making three internal. The internal crest is distinct from the principal cusp in the inferior premolars III and IV, but unites with it in the II; it supports on the IV, an anterior, a median and a posterior cusp, the latter forming part of the rather narrow heel. The true molars I and II have seven tubercles, the four principal ones, and three smaller, one anterior, one posterior, and one median. On the third the posterior forms a large heel. All of the molars, but especially the premolars, have the enamel thrown into sharp parallel folds, in a manner I have not seen in any other mammal. Length of six superior molars, .067; length of three true molars, .029; length of base of third premolar, .012; width of do., .012; width of base of first true molar, .010; do. of third true molor, .009; length of do., .010. Length of base of fourth inferior premolar, .012; width do., .012; of third true molar, .0115; width of do., .009. The teeth indicate an animal of the size of the peccary.

Mioclænus turgidus, gen. et sp. nov. This genus differs from *Catathlæus* in the greater simplicity of the structure of the inferior premolars, which are without internal crest or cusp. The inner lobe of the superior premolars is less developed than that genus. In the *M. turgidus* the characters of *Mioclænus* are

best seen in the subconical tubercles of the premolars, particularly that of the heel of the fourth inferior premolar. In the other three species this heel is more of a crest, and is connected with the principal cusp by a low ridge. The four species may be characterized as follows:

a. Cusps of last premolars conical in both jaws.

Size medium. Last lower molar disproportionately small; cusps low, two anterior inner distinct; true molars, .018.....*M. turgidus.*

aa. Cusps of last premolars compressed in both jaws.

Least. Second and third lower true molars subequal; cusps, especially the internal, elevated; anterior inner confluent into an edge; true molars, .013 *M. angustus.*

Medium. Last inferior molar larger than penultimate; true molars, .014; p. m. III .006.....*M. sectorius.*

Largest. Cusps of inferior molars obtuse; p. m. III .008, its heel short and small *M. mandibularis.*

Of *M. turgidus* there are two specimens; of *M. sectorius* three, and of *M. angustus* and *M. mandibularis* one each.

Geology of the Lake Valley Mining District.—This district lies in the Eastern foothills of the Mimbres mountains, New Mexico, at the western border of a plain which extends from the Rio Grande. Several cuttings of the Atchison, Topeka and Santa Fé R. R. disclose the formation of the surface of the plain, while the shafts at the mines, and various monoclinal hills exhibit the general structure of the country.

The more elevated hills are dikes of trachyte-porphyry, and the directions of their axes are various. It partly decomposes into a reddish soil, and partly breaks down into gravel-like fragments. The lowest sedimentary rock I have seen in place is a quartzite, frequently not very hard, and often perforated by irregular cavities. This material forms low hills, and is overlaid by one or two hundred feet of a fine carbonaceous shale from which most of the valleys are eroded. I was unable to determine the age of either this bed or the quartzite. Overlying the shale are from 150 to 200 feet of more or less siliceous limestone, the upper part of which is very fossiliferous. Professor White finds the fossils to demonstrate the age of this formation to be the Middle Carboniferous; see July, 1881, Naturalist.

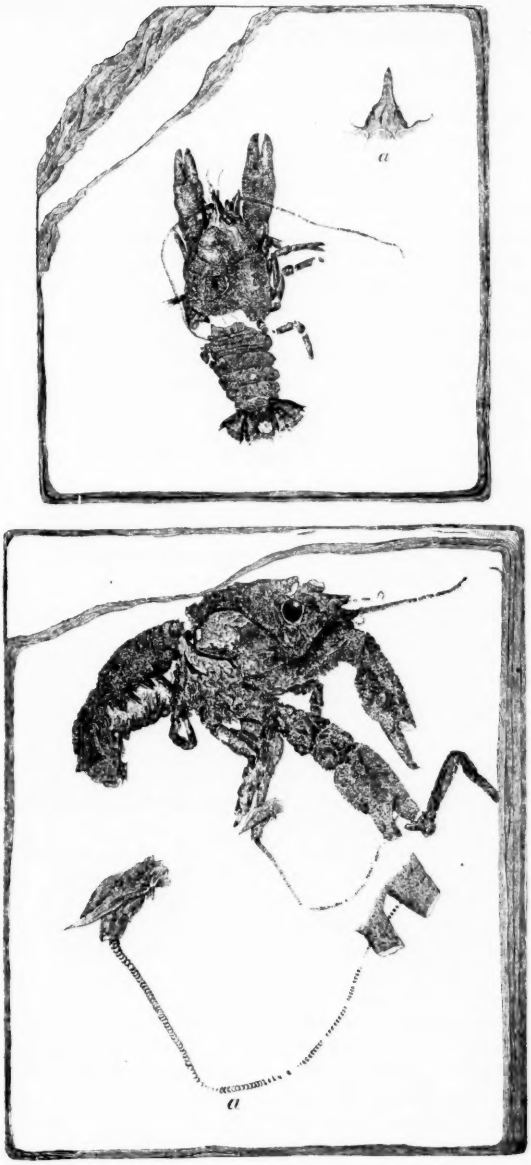
The only formation found covering the limestone is drift. In the foothills this is composed of worn fragments of limestone and trachyte; on the plain it mostly consists of fragments of basalt, with some trachyte, which are more or less coated with lime.

The rich silver deposit which is now attracting attention to this district, is found in the limestone, which forms low monoclinal hills between the higher trachyte ridges and the still lower hills of quarzite. At the Lake Valley mines the dip of the strata is S.S.W. from 12° to 30°. The silver-bearing rock form numerous veins which traverse the limestone from N.W. by W. to S.E. by S., or at right angles to the dips. The veins are of various

widths, from a few inches to a hundred and more feet, and they are nearly uninterrupted for a length of 4000 feet along the sloping surface of the hill. They are probably outflows from an ore body which is bedded with the limestone. At a depth of thirty or forty feet, in some of the shafts, the veins change direction so as to be conformable to the limestone, and many of the veins have been already shown to be connected below the surface. The gangue of the veins is iron oxide and carbonate, with much manganese in pyrolusite, psilomelane, etc., which are mixed with crystalline limestone, chert, etc. Galena and lead carbonate are abundant, and the silver appears as ceratargyrite, embolite and sulphuret. These are either visible in amorphous or crystalline bodies, or are disseminated in an invisible form, but in large quantity, through the gangue substances. The average of the assays is high, especially in some of the ores where the silver is not recognizable by the eye. The green embolite is easily seen in specimens from all parts of this outcrop, and in some larger bodies of gangue it colors the entire rock.—*E. D. Cope.*

A Fossil Tertiary Crayfish.—In a late number of this journal, we described, under the name of *Cambarus primævus*, a fossil crayfish from the Lower Tertiary shales of Western Wyoming. The accompanying illustrations are kindly loaned by Professor F. V. Hayden; they appear in an account of this fossil published in the Bulletin of the U. S. Geological Survey of the Territories. The *Cambarus primævus* is exceedingly interesting from the fact that it represents a period in which heretofore no fossil crayfish has been found. The soft, fine, fissile, clayey shales of the Bear river tertiaries contain not only a good many herring-like fish, but also genuine skates. The presence of land plants mingled with marine animals, shows that the waters were fresh, but communicated with the sea; the conditions were apparently those of a deep estuary into which fresh water streams ran, and in these rivers lived the crayfish. The deposits were probably lower Eocene, and may have been laid down nearer the ocean than those of Green river, if these divisions are to be retained for the Tertiary deposits of the West. At any rate, it is safe to say that the *Cambarus primævus* existed in the Bear river basin in early Tertiary times (the Green river epoch), while the Idaho Astaci were of much later age, possibly of the so-called Pliocene or transition period which connected the Tertiary with the Quaternary period. The *Cambarus primævus* may therefore be regarded as a probable Eocene crayfish.

It thus appears that there is a tolerably complete set of forms of the modern type of crayfish, beginning with the Cretaceous period and extending through the Lower and Upper Tertiary, and culminating in the present assemblage of Astaci and Cambari, with allied forms peopling the cooler parts of the northern hemisphere.



Cambarus primævus, a fossil Tertiary Crayfish.

It was the intention of the writer to examine into the geological succession of the crayfishes, but since the specimens were received for examination, the excellent and thorough work of Professor Huxley, entitled "The Crayfish," has appeared, and his inquiries into the geological succession and probable genealogy of the existing crayfish, completely cover the ground. We will condense the statements of Professor Huxley, in order that the reader may see the interest to be attached to the discovery of the Wyoming fossils.

While the shrimps or Macrura date back to the Carboniferous, being there represented by Anthrapalæmon, with, however, no special affinities to the Astaci, it is not until we ascend to the Middle Lias and strata belonging near the top of the Jurassic series that we find in the genus Eryma, of which some forty species have been recognized, a type which is closely allied to Astacus and Cambarus. It was, however, a marine form, and no fresh-water types existed in the fresh-water beds of the Wealden. In the marine deposits of the Cretaceous epoch, however, astacomorphous forms, which are known by the generic names of Hoploparia and Enoploclytia, are abundant.

"In the chalk of Westphalia (also a marine deposit) a single specimen of another Astacomorph has been discovered, which possesses an especial interest, as it is a true Astacus (*A. politus* von der Marck and Schluter), provided with the characteristic transversely divided telson which is found in the majority of the Potamobiidæ. * * *

"If an astacomorphous crustacean, having characters intermediate between those of Eryma and those of Pseudastacus, existed in the Jurassic epoch or earlier; if it gradually diverged into Pseudastacine and Erymoid forms; if these again took on Astacine and Homarine characters, and finally ended in the existing Potamobiidæ and Homarina, the fossil forms left in the track of this process of evolution would be very much what they actually are. Up to the end of the Mesozoic epoch, the only known Potamobiidæ are marine animals. And we have already seen that the facts of distribution suggest the hypothesis that they must have been so, at least up to this time.

"Thus, with respect to the ætiology of the crayfishes, all the known facts are in harmony with the requirements of the hypothesis that they have been gradually evolved in the course of the Mesozoic and subsequent epochs of the world's history from a primitive astacomorphous form."—(The Crayfish, p. 341–346.)

It will thus be seen that the discovery of an apparently fresh-water Cambarus in the Green River beds of Western Wyoming, which are supposed to be Lower Eocene strata, fills up a break in the geological series hitherto existing between the Cretaceous and Pliocene crayfishes, and shows that the dynasty of fresh-water crayfish, now so powerfully developed in the United States, began its reign during the early Tertiary period.—*A. S. Packard, Jr.*

GEOLOGICAL NOTES.—Professor E. W. Hilgard summarizes in the *American Journal of Science* for July the facts for a hypothesis of a temporary and partial isolation of the Gulf of Mexico from the Atlantic ocean during the later portion of the Tertiary period. In the same journal Professor R. P. Whitfield refers a group of supposed fossil vegetables, named Dictyophyton, to the sponges, and in this view he is confirmed by Dr. J. W. Dawson.——Professor G. H. Stone publishes in the Proceedings of the Boston Society of Natural History, an elaborate discussion of the kames of Maine and the northern States, and in the same publication Dr. M. E. Wadsworth treats of the origin of the iron ores of the Marquette district, Lake Superior, endeavoring to prove that they are eruptive rather than sedimentary. Two other contributions to lithology are comprised in Dr. G. W. Hawe's paper on normal mesozoic diabase upon the Atlantic border, and on the determination of feldspar in thin sections of rocks, in the Proceedings of the National Museum.

GEOGRAPHY AND TRAVELS.[1]

THE IMPERIAL GAZETTEER OF INDIA[2].—The six volumes of this great work now published, with the three yet to be issued, will form one of the most important additions yet made to geographical literature. That excellent authority, Mr. Clements R. Markham, contributes a review of the work to the London *Academy*, from which we learn that in 1862 Madras, Bengal and the central provinces of India, feeling the need of correct information, organized plans for supplying a want for which no provision had been made by the general government and the compilation of manuals for special districts was begun. But the need was felt of a uniform system and a central supervision. In 1869, Dr. Hunter submitted his plan. "It clearly defined the objects of the undertaking and discussed the system through which these objects might best be secured. A series of questions was prepared, the answers to which would illustrate the topographical, ethnical, agricultural, industrial, administrative, and medical aspects of an Indian district. Provincial compilers were then appointed and the series of questions served as a basis for each compiler's local survey. The accounts of the districts were brought together by an editor in each province, on a uniform plan, who prepared the gazetteer of the province, the whole being under the supervision of Dr. Hunter, as Director-General of Statistics to the Government of India. Thus, in the space of twelve years an elaborate account of the 240 districts into which British India is divided was completed, and formed the statistical survey. Such a work, intended as it is to furnish full information to administrators, must

[1] Edited by ELLIS H. YARNALL, Philadelphia.

[2] The Imperial Gazetteer of India. By W. W. Hunter, C. I. E., LL.D., Director-General of Statistics to the Government of India. London, 1881.

be at once comprehensive and minute. Hence the provincial gazetteers or accounts occupy about a hundred printed volumes, aggregating 36,000 pages. A gigantic task has been completed at last, such as had hitherto baffled the efforts of all former governments. At length that central supervision and that methodical arrangement were brought to bear for the want of which so much able and conscientious work had on former occasions become labors in vain. But Dr. Hunter's services did not end here. Although the hundred volumes of information on all that relates to British India were by no means too elaborate for administrative requirements, they were not calculated for general use, and it was necessary to condense their information into an *Imperial Gazetteer* for the use of the public."

"In the Imperial Gazetteer of India great pains have been taken to secure uniformity and due proportion as well as completeness. It was necessary that every place which deserved mention should be recorded; while it was almost equally desirable that each place should receive neither less nor more space than its relative importance demanded. On this principle, about eight thousand places were selected from the statistical survey for treatment in the Imperial Gazetteer. Dr. Hunter then drew up model articles showing the exact order of subject and method of treatment; and thus, although there were several contributors, complete uniformity was secured alike in the preparation of the Gazetteer and in the method of preparing the survey."

"The principal feature of the six volumes that have now been published, is the article on India, which occupies 515 pages and is a complete work in itself. The arrangement of this admirable treatise is made in accordance with sound principles. The three bases of all statistics are space, number and time. Space is the abstract of all relations of co-existence, number of all relations of comparison, time of all relations of sequence. Under the first head Dr. Hunter gives a masterly and most interesting sketch of the geography and physical aspects of British India; under the second he furnishes details of the population; and under the third he has drawn up a condensed history of the people of India, divided into clearly marked periods, from that of the early non-Aryan races to the days of British rule. The value of this excellent historical summary is very much enhanced by the insertion in foot-notes of lists of the principal authorities for each period and each reign."

It supplies a brief but complete history of India from the original sources, Sanskrit, Mohammedan and Hindu, showing the growth of the Hindu race and religion and giving also a clear account of the present system of government.

"The three bases of statistics are naturally followed by economic statistics of production and distribution; and in the important section on agriculture and products Dr. Hunter discusses the

questions of improved husbandry, of irrigation and of famines. Then follow sections on commerce and trade, arts and manufactures, mines and minerals, and on vital statistics, the whole being illustrated by a series of tables." A similar treatment is observed in the articles on Bengal and other provinces, or districts and towns.

In concluding his review Mr. Markham remarks: "The Imperial Gazetteer is the crowning work which brings the results of the great statistical survey within reach of the general public. It represents twelve years of incessant labor demanding many high qualities for its efficient execution and natural gifts such as are rarely combined in one man. Learning, experience and scholarly research were no less essential than habits of accurate thought, administrative talent, and orderly, methodical arrangement. Above all, imagination was needed—that quality without which work cannot be endued with life and movement, but remains dead, a mere receptacle of lifeless facts. It is to the rare combination of literary skill and the imaginative faculty, with the qualifications of an able and energetic administrator, that we owe the completion of this great and difficult task."

This great achievement is a model for our own people. Such a Gazetteer of the United States should be the final result of the explorations, observations and collections that have been and are yet being made under the authority of the National and State Governments.

THE ARCTIC CAMPAIGN OF 1881.—The U. S. steamer *Jeannette* sailed from San Francisco on an exploring voyage through Behrings Straits on July 8, 1879. She was supplied for three years' voyage in the Arctic regions and Captain De Long's instructions do not require him to return until the expiration of that period. The *Jeannette* was last heard from by a letter from Captain De Long, dated August 27, 1879, off Cape Serdze on the north-east coast of Siberia. She was last seen on September 2d of that year by the American whaler *Sea Breeze* about fifty miles south of Herald Island, and on the following day several whalers in lat. 70° 51′ N., long. 174° 30′ W., saw the smoke of a steamer going north a little east of due south of the island. As no news has since been received of her safety, several vessels have been ordered by the Government to visit the Arctic seas for her relief if necessary.

The U. S. revenue steamer *Corwin* sailed on May 4, 1881, from San Francisco, and has already made investigations along the Siberian coast, resulting in the discovery of relics of one of the two missing whalers in the possession of the natives, who had obtained them in November, 1880, from a wreck northward of Cape Serdze. Captain Hooper expected to sail on July 8th from St. Michaels and proceed along the American shore as far as the ice would permit and then attempt to reach Wrangell Land.

The U. S. steamer *Rodgers* sailed from San Francisco on June 16th to search for and relieve the *Jeannette*. She is a full-rigged bark of 420 tons, heavily sheathed with three-inch oak plank. She is supplied with stores for four years, including large quantities of pemmican and lime juice. She is commanded by Lieutenant R. M. Berry and has a company of 35 officers and men. The paymaster is W. H. Gilder, formerly of the Schwatka expedition. She is to proceed to the coast of Siberia and thence to Herald Island and Wrangell Land, where Lieut. Berry hopes to winter.

The U. S. frigate *Alliance* has been ordered to cruise in the northern Atlantic, visiting the coast of Spitzbergen, in view of the possible return of the *Jeannette* by the east coast of Greenland or the shores of Franz-Josef Land. The *Alliance* sailed from Norfolk on June 16th, arrived at Reikiavik, Iceland, on July 9th, and at Hammerfest on the 25th.

Congress having appropriated the sum of $25,000 to the establishment of two stations within the Arctic circle, at Lady Franklin Bay and Point Barrow, in accordance with the plan adopted by the Hamburg International Polar Conference, the parties to occupy them have been organized and despatched. The Lady Franklin Bay Colony will number twenty-six, commanded by Lieut. A. W. Greely, for twelve years acting signal officer, with two other officers, sixteen soldiers, four observers, one naturalist, two surgeons and one photographer. They sailed in the steamer *Proteus* from St. Johns, N. F., on July 7th. They go first to Disco to procure Eskimo guides, dogs and furs, and expect to be joined there by Dr. Pavey and Mr. H. Clay, who were left there by the *Gulnare* last year. The *Proteus* will then visit Lancaster Sound to see if any traces of the *Jeannette* are to be found, as is thought not unlikely, and then continue her course for Lady Franklin Bay in lat. 81° 40′. She will endeavor to call at Carey island and at the cachès made by the English in Grinnell Land, which will be supplemented by supplies from the *Proteus*. On reaching Lady Franklin Bay the vessel is to be unloaded at once, so as to return to St. Johns. The expedition is provided with a number of portable houses and full supplies of stores of the best quality, including a very large stock of anti-scorbutics. After erecting the dwelling house and observatories, a sledge party is to visit Cape Joseph Henry to seek for tidings of the *Jeannette*. Full instructions are given by the War Department for the forming of collections and taking of observations of all kinds, as recommended by the Hamburg Conference. It is expected that the station will be visited yearly by steamers to replenish stores and bring back any disabled members of the party. Lieut. Greely is ordered to abandon his station not later than September 1, 1883, if not previously visited, and retreat southward by boat, following the east coast of Grinnell Land until the relieving vessel is met or Littleton island reached.

The Point Barrow party sailed on July 18th, from San Francisco on the schooner *Golden Fleece*. It consists of ten men, including the commander, Lieutenant P. H. Ray, a surgeon, astronomer, three observers, interpreter, etc. They take 16,000 feet of lumber, for the erection of a building thirty by forty feet and astronomical and magnetic observatories. The party is excellently equipped with instruments and is provisioned for two years. A vessel is expected to reach them annually. They are to remain for three years.

Many of the outlets from the Arctic sea are this year reported unusually obstructed by ice. Heavy ice floes are reported along the Labrador coast, and the pack ice is unusually heavy and far south in the European Arctic sea—Spitzbergen being at last advices entirely inaccessible. The past winter was unusually severe in Iceland. Owing to the large flow of ice it is thought that later in the season the seas in the higher latitude will be left unusually free and navigable.

The weather on the south-west coast of Greenland during the winter of 1880–1, is stated, however, to have been the mildest ever experienced in that vicinity. No ice formed in the bays or fiords and but little snow fell. The prevalence of south-west gales is assigned as one cause of this unusual climate.

Mr. Leigh Smith sailed from Peterhead in the third week of June. On reaching Eira Harbor in Franz-Josef Land, he purposes to construct a house from materials taken with him and then explore as far north as possible. He has a company of twenty-five sailors and assistants and provisions for fifteen months.

Besides Lady Franklin Bay and Point Barrow, the stations recommended to be established by the Hamburg Conference are Upernavik by Denmark, in Northern Finnmarken by Norway, on Jan Mayen and western coast of Greenland by Austria, on Spitzbergen by Sweden, on Novaya Zemlya [already opened] and at the mouth of the Lena by Russia.

The *Nature* states that the Swedish Government has decided to send a scientific expedition to Mossel Bay in the course of next year, for the purpose of collecting meteorological information. The expedition will be directed by Capt. Malmberg and will have to remain during the summer of 1882 and the winter of 1883, in order to obtain the observations of an entire year. Mossel Bay is situated to the north of Spitzbergen, lat. 79° 54′, long. 16° 15′. The locality is well known to the Swedes. Professor Nordenskiöld stayed there in the winter of 1872–3 with three ships.

MICROSCOPY.[1]

METEORIC DUST.—From time to time fine dust, having nearly the same composition as certain meteorites, has fallen upon various parts of the earth's surface. * * * Professor Silvestri,

[1] This department is edited by Dr. R. H. WARD, Troy, N. Y.

of Catonia, recently collected some dust which fell in Sicily, and found it to contain not only metallic iron, but also nickel and various silicates and phosphates, such as are commonly found in meteoric stones. He is, therefore, inclined to believe either that the dust has been abraded from meteorites, or that it circulates in space, and is attracted to the earth's surface when it penetrates within the atmosphere.

Professor Tacchini, who has exchanged the observatory of Palermo for that of the Collegio Romano, in Rome, has recently published a lengthy memoir entitled "Sulle polveri meteoriche di Scirocco raccolte in Italia e segnatamente in Sicilia." He was assisted in his researches by Professors Macagno and Ricco, and a résumé of the results at which they arrived, was recently read before the meteorological section of the French Association for the Advancement of Science at Algiers. The memoir contains some beautifully-executed microscopic drawings of the appearance of the meteoric dust when highly magnified, and by a series of small maps showing the barometric curves for the periods during which the dust fell. * * * A notable feature revealed by the analysis, was the similarity of the composition of the dust collected from various localities and at different epochs. * * * A microscopic analysis revealed the presence of transparent and opaque polygonal crystals, black granules of metallic iron, and of magnetic oxide of iron, feldspar, carbonate of calcium and sand; various vegetable substances and spores were observed, *Palmella cruenta*, *Protococcus nivalis* v. *pluvialis* and *Discerœa purpurea*. Professor Tacchini considers that the dust is of terrestrial origin, and that it is brought from the Sahara, being raised into the higher regions of the atmosphere by cyclones and whirlwinds, where it may remain suspended during transport for several days. A barometric depression invariably accompanies the fall of the dust.—*G. F. Rodwell in Science Gossip.*

Microscopy in the American Association for the Advancement of Science.—At the meeting of the American Association for the Advancement of Science, held recently in Cincinnati, the sub-section of microscopy had several important and interesting sessions, at which a number of valuable papers pertaining to the science of histology and the *technique* of microscopy were presented. Rev. A. B. Hervey, of Taunton, Mass., was chairman, and Professor Wm. H. Seaman, of Washington, was secretary.

In the reorganization of the American Association, which was perfected at the Cincinnati meeting, the full section of "Histology and Microscopy" was established, by which this was put on a footing of equality with the other departments of science represented in the Association. By this arrangement the chairman of the section becomes a vice-president of the Association, and he, together with the secretary and a fellow elected by the section, represent the section in the standing committee. It is believed

that this action on the part of the Association will be gratifying to every student of histological and microscopical science in the country. It can hardly fail to furnish the most favorable and considerable advantage to all who care to enjoy the privileges of a national microscopical society. Professor A. H. Tuttle, of Columbus, was elected chairman, and Robert Brown, Jr., of Cincinnati, secretary of the section for the Montreal meeting.—*A. B. H.*

NEW FREEZING MICROTOME.—At the microscopical section A. A. A. S., Mr. Thomas Taylor, Microscopist of the Department of Agriculture at Washington, presented a model of a new freezing microtome of his invention. Mr. Taylor described his invention as consisting essentially of a thin brass tube about one inch and a half in length by one inch in diameter. A ¼ inch brass tube is secured within the large cylinder. This tube enters the bottom where it is secured, and proceeds to within a quarter of an inch of the inside surface of the top. To the outside open end of this tube a rubber tube is attached; the other end of the rubber tube is made to communicate with a freezing mixture composed of finely cut ice and salt in about equal proportions. The pail containing this mixture is placed over and about fifteen inches higher than the section cutter. The object of this arrangement is to fill the brass cylinder with a freezing liquid, drained from the pail, and caused by the liquifying salt and ice, the temperature of which is about zero. On filling the cylinder with the liquid any object on the top of the cylinder becomes frozen in a short period and may then be cut to any degree of thickness. In order to preserve the low degree of temperature in the cylinder a second tube is secured in the cylinder to remove air and keep up a constant current of the freezing liquid. This tube enters the bottom of the cylinder, where it is fastened. It projects upwards to within an eighth of an inch of the top and has a diameter of about one-half of the supply tube. This microtome or freezing cylinder in other respects is arranged like other microtomes such as are used for ether or rhigoline; and the same mathematical accuracy attained in cutting sections.

MOUNTING CHICK EMBRYOS WHOLE.—Dr. C. S. Minot recommended the following method, for embryos under 40 hours. The egg is opened in the usual manner in warm 0.5 per cent. salt solution, the blastoderm freed from the yolk membrane, then swayed with pincers to and fro in the liquid to remove the superfluous yolk, and then floated out on a glass slide, on which it is to remain permanently. It is next treated with several fluids; *all* of which should be dropped on the center of the germ disc so as to spread out the blastoderm evenly by their centrifugal flow. Wash off thoroughly with distilled water. Remove the water as fully as possible by bibulous paper, and allow the specimen to remain fully spread out until the edges are dried. The embryo will then

escape distortion during the further treatment. Care must be taken that the embryonic area remains moist. Drop on two drops of a ½ per cent. osmic acid solution, leave standing for two or three minutes until a slight browning is produced, wash off again with distilled water, strain with picrocarmine, which dyes the blastoderm after a variable time according to the intensity of the osmic acid action. The next step is important because it stops the further darkening by the osmium, which otherwise injures or ruins the specimen. Pour Müller's fluid, or 0.5 per cent. chromic acid solution on the slide and leave it over night. The next morning the blastoderm is ready for dehydration by alcohol, and mounting in the usual manner in balsam, or better in three parts pure Canada balsam mixed with one part d'Ammar varnish, as furnished by the microscopical dealers.

Embryos mounted in this way make very perfect preparations, surpassing, indeed, those otherwise treated.

——:o:——

SCIENTIFIC NEWS.

— The method of teaching elementary botany at the Michigan Agricultural College, by Professor W. J. Beal, seems to us to be so excellent, that we extract the following reference to it in his address, entitled "Our Agricultural Colleges," given to the Connecticut Board of Agriculture, in 1880, and which has just been printed:

"Before the first lesson each pupil is given some specimen to study. If flowers or growing specimens cannot be had, give each a branch of a tree or shrub, which branch may be two feet long. The examination of these is made during the usual time for preparing lessons, and not in the class room. Without having the specimen in sight, they are to tell what they can about them for the next recitation. They can use books if they prefer, though it is better that they do not. No books can be found that will give much assistance on such a lesson. The time arrives, and the hour is mostly spent in hearing different members report their discoveries, until all have had a chance to add anything not noticed by any other member. The teacher suggests a few other points for study. The pupils are not told about things which they can see for themselves. An effort is made to keep them working after something which they have not discovered. If two members disagree on a point, on the next day, after further study, they are requested to bring in all the proofs they can to sustain their separate conclusions.

"It is often astonishing to notice how much is discovered by so many good eyes. For the next lesson the students review the first lesson, report on a branch of another kind of plant which they have studied, and notice the points of difference and simi-

larity between the two. In like manner new branches are studied and new comparisons made.

"For some weeks but little use is made of microscopes or text-books. In nearly all important cases specimens are examined, and a need felt for a name or a definition before these are given. After a few lessons answers to the following points are brought out:

"Is there any definite proportion of active to dormant buds in any year? Where do branches appear? Is there any agreement in growth as to length of branch and size of the annular ring each year? Is there any similarity of rapid or slow growth of all the limbs on a branch in each year? Is there any certain number of leaves on a year's growth, or any definite proportion between the length of internodes? Can the smallest, old, dormant buds be made to grow? Is there any order as to what buds grow and what remain dormant? How much and on what years did each limb grow? There are three ways of telling the age of a branch—by the bud-rings, stem-rings and color of the bark. The shape, other peculiarities, and variations of buds, and leaf-scars in any species are noted; also the arrangement and position of the buds and bud-scales. Is there any order in the arrangement of the specks on a branch? Do the specks change as the branch grows older, and if so how? How many leaves each year were required to build up the branch? How large were the leaves and the amount of surface exposed? Did the amount of growth in any year correspond to the number of leaves on the twigs and main axis? Does the ring of wood depend on the growth of the main axis? The arrangement of the scales of cones are studied in this connection. In each case the students are requested to try to classify the topics or place them under proper headings. They are now ready for a book lesson on branches, buds and phyllotaxis, and they will read it with interest and profit.

"In like manner any other topic can be taken up, provided plenty of specimens can be supplied, as roots, seeds, fruits, stamens, petals, sepals, leaves, etc. After each of these comes the study of the book. Beginners should study plants and refer to books, and not study books and refer to plants.

"Some of the above topics are admirably well adapted for theses or compositions. I usually give each student one or more of them each term. For the younger students this year, the following topics will serve as examples: 'Compare the leaves and young branches of the Scotch pine with those of the Austrian pine,' or 'black spruce and Norway spruce,' or 'sugar maple and red maple,' or 'butternut and black walnut.'

"As students advance in systematic botany and morphology, other subjects for theses are assigned, of which the following may serve as examples:

"The arrangement and development of parts of the flower,

with reference to its self-fertilization, or fertilization by insects, birds, winds, or by other means. Below are samples: Moth-mullein, dog-bane, common sage, thyme, red clover, plantain, milkweed, mallow, thistle, cleistogamous flowers of violet, campanula, iris, lobelia, martynia, Indian corn, wild balsam. One student may study the vines of dodder; one, the climbing of Virginia creeper; one, the twining of the wild morning-glory; one, cucumber tendrils; one unequal-lobed leaves; one, the time of opening and closing of flowers; several, the development of some irregular flowers; one, the order of dehiscence among anthers of a flower; one, the honey-glands of some flower; glands in other parts of plants than flowers; growing beans in all sorts of soil and with more or less light; the germinating power of weevil-eaten peas; the relative order of development of stamens and pistils of many plants of Indian corn; for what do ants visit plants?

"The theses were made up of original investigation and experiments, and were read in class. Students use stage microscopes. Later in the course, each is supplied with a good compound microscope, in a suitable room, where he works daily for a term. Pupils prepare their own slides, make notes and drawings, which are preserved at the college. Most of the time for the term is spent on one plant, a favorite of which is the common pumpkin."

— The British Association began its meetings Wednesday, Aug. 31, at York, when Professor A. C. Ramsay, Director-General of the Geological Survey of the United Kingdom, and of the Museum of Practical Geology, resigned the chair; and Sir John Lubbock, president-elect, assumed the presidency, and delivered an address. On Thursday evening there was a soirée in the assembly-rooms and concert-rooms. On Friday evening Professor Huxley discoursed on the "Rise and Progress of Palæontology." On Saturday evening Professor Osborne Reynolds, F.R.S., delivered a popular lecture to the working classes. On Monday evening Mr. Spottiswoode, president of the Royal Society, gave an address on the "Electric Discharge, its forms and its functions." On Tuesday evening there was a soirée. On Wednesday, September 7, the concluding general meeting was held at 2.30 P.M.

—The *Penn Monthly* for August contains an excellent biographical notice of the late Professor S. S. Haldeman, by Professor C. H. Hart. Among recent deaths of scientists we have to chronicle that of Dr. Ferdinand Keller, the distinguished Swiss archæologist and author of a well known work on Lake dwellings. He died at Zurich, July 21, aged 80 years. A prominent English botanist, H. C. Watson, born in 1804, and author of several works, including "Cybele Britannnica," died in July. Dr. Phil. de Rougemont died at Neuchatel, May 27.

— Among recent Bulletins of the Census are the statistics of the fisheries of the Great Lakes for 1879, prepared by Mr. F. W. True from notes furnished by Mr. Ludwig Kumlien; the total value is $1,784,050. The production of anthracite coal in Pennsylvania for 1880 was 27,433,329 tons, a gain of 75.9 per cent. over 1870. The production of salt was a little less in 1880 than in 1870. Of cotton 5,737,257 bales were produced in 1880, Mississippi producing most, Georgia being the next heaviest producer.

— Professor Snow of the University of Kansas and his party, recently had a narrow escape from death, at the hands of the hostile Apache Indians, in New Mexico. They were besieged for three days in the water cañon of the Magdalena mountains, and made their escape on foot to Socorro, after concealing their personal property. On the road they passed a party of freighters lying dead beside their wagons, victims of the Indians' murderous propensities.

— Two of the parties of the U. S. Geological Survey under Major J. W. Powell, are at Fort Wingate, N. Mex. These are under the immediate direction of Messrs. Thompson and Gore. Mr. and Mrs. James Stevenson, of the same survey, are also there, preparing for an investigation into the archæology and ethnology of the surrounding region. There is some risk that the operations of these parties will be interfered with by the hostile Apaches.

Carlile P. Patterson, Superintendent of the U. S. Coast Survey, is dead. His successor has not yet been appointed, but it is anticipated that it will be Julius E. Hilgard, for a long time the able second officer of the survey.

— Mr. G. Brown Goode has been appointed, by Professor Baird, Curator of the National Museum, Washington. An excellent appointment.

— The German Association of Naturalists and Physicians was to hold its meetings at Salzburg from Sept. 17 to 24.

——:o:——

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

American Association for the Advancement of Science.— The thirtieth meeting was held at Cincinnati, Aug. 17–23, 1881. The meeting was as largely attended as any ever held except the last (Boston) meeting, and everything was done by the hospitable citizens of Cincinnati to render the session pleasant and profitable. The next meeting will be held at Montreal. Dr. J. W. Dawson, of Montreal, was elected president, and William Saunders, Esq., of London, Canada, general secretary, for the next year.

Following are the titles of papers read on biology, geology and kindred sciences:

On the ancient Japanese bronze bells. Edw. S. Morse.
On changes in Mya and Lunatia since the deposition of the New England Shell-heaps. Edw. S. Morse.
On worked shells in New England Shell-heaps. Edw. S. Morse.
Natural and industrial history of the White Pine in Michigan. Wm. Hosea Ballou.
Phenomena of growth in plants. D. P. Penhallow.
On the life duration of the Heterocera (moths). J. A. Lintner.
On the length of life of Butterflies. W. H. Edwards.
How does the Bee extend its tongue. A. J. Cook.
The Syrian Bees. A. J. Cook.
Carbolic acid as a preventive of Insect ravages. A. J. Cook.
On certain habits of *Heliconia charitonia*. W. H. Edwards.
Historic notes on Cosmic Physiology. T. Sterry Hunt.
The uncivilized mind in the presence of higher phases of civilization. Otis T. Mason.
The best method of mounting whole chick embryos. Charles Sedgwick Minot.
Note on whether man is the highest animal. Charles Sedgwick Minot.
Note on the segmentation of the vertebrate body. Charles Sedgwick Minot.
The motion of roots in germinating Indian corn. W. J. Beal.
Exhibition of some archæological specimens from Missouri. S. H. Trowbridge.
Animal myths of the Iroquois. Mrs. Erminnie A. Smith.
A remarkable invasion of Northern New York by a Pyralid insect (*Crambus vulgivagellus*). J. A. Lintner.
Recent discoveries, measurements and temperature observations made in Mammoth Cave, Ky. H. C. Hovey.
A remarkable case of retention of heat by the earth. H. C. Hovey.
Coal dust as an element of danger in mining; shown by the late explosion in the Albion mines in Nova Scotia. H. C. Hovey.
A revision of the anatomy of the ethmoid bone in the Mammalia. Harrison Allen.
The life unit in plants. Byron D. Halsted.
On *Bopyrus manhattensis* from the gill-cavity of *Palæmonetes vulgaris* Stimpson. Carl F. Gissler.
The stone images and idols of the mound-builders. Wm. McAdams.
Some remarkable relics from the mounds of Illinois. Wm. McAdams.
Stone implement showing glacier marks. Wm. McAdams.
The occurrence of Cretaceous fossils near mouth of Illinois river. Wm. McAdams.
Mound-builders' skeletons. Watson C. Holbrook.
Stone implements in the drift. Watson C. Holbrook.
Prehistoric hieroglyphics. Watson C. Holbrook.
A contribution to Croll's theory of secular climatal changes. W. J. McGee.
Influence of forests upon streams. David D. Thompson.
Mineralogical Notes. Benjamin Silliman.
On the influence of the structure of the nerve-fibres upon the production and conduction of nerve-force. H. D. Schmidt.
The recurrence of faunas in the Devonian rocks of New York. H. S. Williams.
Note on some fish remains from the Upper Devonian of New York. H. S. Williams.
Some phenomena in the conjugation of the infusorium Actinophrys sol. J. D. Cox.
Note on specimens of Ptilophyton and associated fossils collected by Dr. H. S. Williams in the Chemung shales of Ithaca, N. Y. J. W. Dawson.
A contribution to the study of Bacterial Organisms, as commonly found on exposed mucous surfaces and in the alimentary canal of healthy individuals. Geo. M. Sternberg.
On recent deep-sea soundings in the Gulf of Mexico and Caribbean sea, by the U. S. Coast Survey. J. E. Hilgard.
A new and improved freezing Microtome. Thomas Taylor.
Bacteria and Micrococci, and their relations to plant culture. Thomas Taylor.

The Berea Grit of Ohio. Edward Orton.
The Gold-bearing drift of Indiana. Geo. Sutton.
On the amount of Glacial erosion in Ohio, Indiana, and Illinois, with some deductions therefrom. E. W. Claypole.
On the discovery of an Archemediform Tenestellid in the Upper Silurian rocks of Ohio. E. W. Claypole.
Life-history of the Buckeye Stem-borer (*Sericoris instrutana* Clem.) E. W. Claypole.
Some needed reforms in the use of Botanical Terms. Charles E. Ridler.
The excavation of the Grand cañon of the Colorado river. C. E. Dutton.
On the cause of the arid climate of the far West. C. E. Dutton.
Evolution and its place in Geology. Edward S. Edmunds.
The evidence from the Drift of Ohio in regard to the origin of Lake Erie. E. W. Claypole.
A short study of the features of the region of Lower Great Lakes during the Great River age; or notes on the origin of the Great Lakes of North America. J. W. Spencer.
On the inhabitants of N. E. Siberia, commonly called Chukchis and Namollo. W. H. Dall.
A lawgiver of the Stone age. Horatio Hale.
Ilex cassina, the black drink of the Southern Indians. John G. Henderson.
Was the antelope hunted by the Indians on the prairies of Illinois? John G. Henderson.
Agriculture and agricultural implements of the ancient inhabitants of the Mississippi valley. John G. Henderson.
Houses of the ancient inhabitants of the Mississippi valley. John G. Henderson.
Comparative differences in the Iroquois group of dialects. Mrs. Erminnie A. Smith.
Typical thin sections of the rocks of the Cupriferous series in Minnesota. N. H. Winchell.
The limited biological importance of synthetic achievements in organic chemistry. Albert B. Prescott.
Retarded development in Insects. C. V. Riley.
New Insects injurious to American agriculture. C. V. Riley.
The egg-case of *Hydrophilus triangularis*. C. V. Riley.
On the oviposition of *Prodoxus decipieus*. C. V. Riley.
The cocoon of *Gyrinus*. C. V. Riley.
Ozark highlands. G. C. Swallow.
On the disposition of color—markings of domestic animals. Wm. H. Brewer.
On a mesial cusp of the deciduous mandibular canine of the domestic cat, *Felis domestica*. Burt G. Wilder.
Remarks on the classification and distribution of Producti. S. H. Trowbridge.
The temperature of North German Traps at the time of their extrusion. H. Carmichael.
Recent existence of sword-fish, shark and dolphin in the fresh-water pond near Buffalo, N. Y. Wm. Zimmerman.
Antiquity of Man in America. W. De Haas.
Progress of Archæological Research. W. De Haas.
The Mound Builders; an inquiry into their assumed southern origin. W. De Haas.
Additional facts on the fertilization of Yucca. Thomas Meehan.
On the interpretation of Pictographs by the application of gesture-signs. W. J. Hoffman.
An alleged abnormal peculiarity in the history of *Argynnis myrina*. W. H. Edwards.
On a convenient form of slide case. Robt. Brown, Jr.
On some relations of Birds and Insects. S. A. Forbes.
Comparison of Maya dates with those of the Christian era. Cyrus Thomas.
Notice of a Fern indigenous to California, but heretofore considered as an introduced hothouse species. Mrs. Leander Stone.
Fossil teeth of Mammals from the Drift of Illinois. Wm. McAdams.
The Unification of geological nomenclature. Richard Owen.

MIDDLESEX INSTITUTE, Malden, Mass., June 17.—The annual field meeting of the institute was held on Bear hill, in the Mid-

dlesex Fells, Stoneham. A large number of guests were present, and the day passed enjoyably. Many plants not previously collected were added to the list of our county flora, and Mrs. P. D. Richards found that rare plant, *Habenaria hookeri.*

June 22.—An exhibition of native plants from Malden, Medford and other parts of the county, was held in Institute Hall, and attracted a large number of visitors.

July 27.—A special exhibition of the native ferns of Middlesex county was given with gratifying success. Mr. Frohock exhibited *Woodwardia angustifolia* from Medford, Mass., found for the first time within the limits of Middlesex county, and Mr. Dame exhibited *Botrychium matricariæfolium* from Stoneham.

Arrangements are partially completed for a course of scientific lectures to be delivered during the winter months.

——:o:——

SELECTED ARTICLES IN SCIENTIFIC SERIALS.

Quarterly Journal of Microscopical Science, July.—On the lymphatic system of the skin and mucous membranes, by E. Klein. The development of the water glands in the leaf of *Saxifraga crustata*, by W. Gardiner. The development of the Spermatozoa, Part II. Helix and Rana, by J. E. Blomfield. On the early development of the anterior part of the wolffian duct and body in the chick, together with some remarks on the excretory system of the Vertebrata, by Adam Sedgwick. Observations on the cranial nerves of Scyllium, by A. Milnes Marshall. On the occurrence of corpuscles in the red vascular fluid of Chætopods, by J. E. Blomfield. Pacinian corpuscles in the pancreas and mesenteric glands of the cat, by V. Harris. Limulus an Arachnid, by E. R. Lankester.

The Geological Magazine, August.—On the Archæan rocks, by C. Callaway. The Megaceros in Ireland, by W. Williams. The glaciation of the Shetlands, by B. N. Peach and J. Horne.

Annales des Sciences Naturelles, June.—Monograph of the birds of the family Megapodiidæ, by E. Oustalet, 2d part. New researches on the organization and development of Gordiacea, by M. Villot. Description of macrurous Crustacea from great depths of the seas of the Antilles, by A. Milne Edwards.

Jenaische Zeitschrift fur Naturwissenschaft, July 31.—On the muscles of the eye of Ganoids, by H. Schneider. The mouth-arms of Rhizostomæ and their appended organs, by O. Hamann. The development of the middle germ-layer of vertebrates, by O. Hertwig.